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UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Vol. 4 No. 23

Dec. 15, 1950

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NUCLEAR SCIENCE ABSTRACTS

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Erratum for NSA, Vol. 4, No. 20

In the journal reference for abstract 4-5848, Nuclear Science Abstracts 4, 867(1950) Oct. 30, the title Exptl. Med. should be replaced by Z. ges exptl. Med.

Erratum for NSA, Vol. 4, No. 2

Abstract 4-371, Nuclear Science Abstracts 4, the bibliographic information should read: Methods of Using Radioisotopes in Chemical and Biological Research. M. Guillot. Rev. gén. sci. 56, 168-76(1949)(In French).

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AECD-2929	Technical Physics Handbook; Technological Division. M. H. Wilkening.	6626
AECD-2931	The Isotopes of Americium. K. Street, Jr., A. Ghiorso, and G. T. Seaborg.	6681
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GENERAL

6493 Burns in Atomic Warfare. George F. Lull. Today's Health, 19 and 44(1950) Oct.

A brief discussion of the medical problems to be faced in the event of an atomic bomb attack is presented, with emphasis being placed on the necessity for treatment of thousands of burn casualties.

6494 A Guide for the Preparation of Reports. R. H. Lafferty, Jr., ed. K-105(Revised), Sept. 13, 1950. 59p.

The purpose, content, and style together with rules of form for the written and illustrative material contained in a report are presented. Sample pages, report format, reproduction methods, preparative outlines, and standard abbreviations applicable to reports originating at the Gaseous Diffusion Plant of the Carbide and Carbon Chemicals Division of Union Carbide and Carbon Corporation at Oak Ridge, Tennessee, are illustrated and discussed. The presentation is sufficiently general to be of interest to anyone interested in the writing of technical reports.

6495 The Work of the French Atomic Energy Commission as Presented by Dr. L. Kowarski. Paul M. Marcus. Office of the Naval Attaché, London. NP-1286, March 17, 1950. 7p.

The work of the first four years was reviewed, starting with the various difficulties and advantages confronting the Commission since its beginning in 1945. In the former category were mentioned the lack of scientific knowledge in the field of nuclear physics and the poor state of the French economy, while in the latter category the adventurous spirit of the times and the tradition in radioactivity research were noted. The preparatory stage in setting up the first laboratories, workshops, and instrument production at Chatillon was described, as well as the beginning of the eventually successful prospecting for uranium ore. In the second stage of the development of the Commission came the building of the nuclear reactor (ZOE). This reactor develops about 5 kw, uses uranium oxide as the active material and heavy water as a moderator. A larger reactor is now being planned at a new location, where a cyclotron and electrostatic accelerator will also be located. The future plans of the Commission, and the present position and influence of the Commission in France and outside are discussed. The desirability of an international atomic organization for European countries is emphasized but various difficulties in forming it are pointed out.

BIOLOGY AND MEDICINE

6496 The Absorption, Distribution, and Excretion of Tritium in Men and Animals. Ernest A. Pinson and Ernest C. Anderson. Los Alamos Scientific Laboratory. LADC-867, nd. 4p.

The tritium absorbed by rats from inspired air containing HT or HTO is proportional to the tritium activity in the inspired air. When present as HTO a very high percentage of the tritium activity inspired is taken into the body fluids indicating rapid exchange and absorption of activity across respiratory membranes. If present as HT in inspired air only about 0.05% of the inspired activity appears in the body as HTO. Apparently, biological catalyzation of HT to HTO takes place in the body. The activities studied were not high enough for the absorption of HT per se in body fluids to be detected. Three millicuries of HTO ingested by man in 200 cc of water was completely absorbed in about 45 min. Absorption is linear with time. Absorbed tritium dilutes with 57 to 68% of the body weight suggesting that body water is primarily involved. Tritium elimination from the body in both rats and man is an exponential function of total water turnover. The reservoir calculated from the rate constant is again 57 to 68% of the body weight. The biological half life of HTO in nine human subjects varied from 9 to 14 days on ad libitum water intake and was reduced to 2½ days in one subject on high water intake. The biological half-life in rats ranged from 4 to 5 days on ad libitum water intake. The tritium activity in excreted sweat, insensible perspiration, expired water vapor, sputum, and urine is essentially the same as that in the blood. (auth)

6497 An Improved Method for the Artificial Insemination of Mice. J. C. Kile, Jr. ORNL-808, Sept. 1, 1950. 15p.

Several methods for the artificial insemination of mice were tested, of which the following proved to be most satisfactory and more successful than any reported by other workers. Females were inseminated during the cyclic estrus at from 1.5 to 4.5 hr following mating with a vasectomized male. After mid-ventral laparotomy, the sperm suspension was introduced through the wall of each uterine horn with a 28-gauge hypodermic needle. Of 103 inseminations made within the C57 brown strain, 74 (71.8%) were fertile. The mean litter size was 5.97. (auth)

6498 Lung Hemorrhage Produced in Heparinized Mice by Air Blast. Benedict Cassen, Katherine Kistler, and Wanda Mankiewicz. UCLA-89, Sept. 1, 1950. 11p.

An improved technique of measuring the degree of pulmonary hemorrhage produced in mice by air blast is described. This method was applied to a study of the effect of waiting definite periods of time before autopsying heparinized mice which had been subjected to air blast. It was found that the degree of hemorrhage was not changed appreciably by waiting up to 15 to 20 min. However, after waiting 20 to 25 min the degree of hemorrhage increased and became more scattered about its average value. The provisional interpretation best fitting the observations is the assumption that capillary vasoconstriction is the first line of defense against blood loss after injury, but that this vasoconstriction wears off in about 15 to 20 min. If clotting processes have not progressed during this time, bleeding begins again. This is in agreement with some results reported in the literature on experiments on peripheral-vessel bleeding. (auth)

6499 Role of Metal Ions in Enzyme Systems. A. L. Lehninger. Physiol. Revs. 30, 393-429(1950) July.

The role of metal ions in the catalytic action of various enzymes is of the highest importance to metabolism and toxicology studies. For example, competitive inhibition of Mg^{++}- or Ca^{++}-activated enzymes or physiological replacement of these ions by Be^{++} may be the basis for the rachitogenic and sarcomagenic activities of beryllium salts. Properties of metallic ions, their biological specificities and interactions with proteins and substrate molecules, the various classes of metalloenzymes, and the nature of the structural linkage between the metal ions and the molecules are discussed in this extensive review. 253 references.

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6500 The Effect of X-rays on Fibrinogen. H. A. Scheraga and L. F. Nims. Cornell University and Brookhaven National Laboratory. AECU-968, nd. 1p.

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High doses of two-million-volt x rays produce a marked increase in the viscosity of solutions of bovine fibrinogen. Examination of these solutions in the ultracentrifuge indicates the presence of significant amounts of an additional component of higher sedimentation constant than that of the original material. Simultaneous studies of the thrombin-induced clottability of these solutions seems to indicate that the clotting activity is not significantly decreased even though there are these changes in the structure of the native fibrinogen. The character of the clots does change, however, the clots formed from solutions irradiated with the higher doses compacting and breaking up upon slight mechanical disturbance; those clots formed from the original material and also those from solutions irradiated with the smaller doses exhibit normal syneretic properties at the pH studied.

6501 Performance Studies on Animals Exposed to External Radiation. II. Exhaustive Exercise Tests on Rats Exposed to X-rays in the Lethal Dose Range. D. J. Kimeldorf and D. C. Jones. Naval Radiological Defense Laboratory. AD-241(B), Aug. 25, 1950. 23p. (See also NSA 3-518)

The performance of rats in a standardized exhaustive performance test was depressed following whole-body irradiation with relatively lethal doses of x-rays (700 and 860 r). The extent of performance depression appears to be related to the post-irradiation survival time. The extent and rate of mortality following irradiation, with the doses described, were markedly increased by repeated periods of exercise in the post-irradiation survival time. (auth)

6502 Some Effects of Gamma Rays on Recombination and on Crossing Over in Drosophila Melanogaster. Maurice Whittinghill. ORNL-817, Sept. 11, 1950. 43p.

Gamma-ray treatment of 4000 r given to adult Drosophila melanogaster females altered crossover values in a regular pattern in rucuca heterozygotes. Increases were greatest, relative to controls, in the spindle-attachment region in the middle of the third chromosome, progressively less in each successive region farther out, and negative in the two most distal regions. Coincidence of double crossover combinations was increased relative to control coincidence values in a similar curve but without distal decreases. Great individual variation in crossover production after gamma-ray treatment was shown by regular females, by inversion females, and by regular males. The changes might have originated in meiotic or in gonial cells. The distribution of crossovers among families from gamma-ray-treated Curly Lobe[4] inversion heterozygotes had a probability of 0.001 of resulting from meiotic crossing over. It has been attributed to oögonial crossing over in these females. The 4000-r treatment induced crossovers in 14 of 59 treated males in an even greater nonrandom distribution which was due to spermatogonial crossing over. A new crossover-selector system of testing was employed here. Expression in ratio form of the regionally different effects of starvation of larvae upon crossover production shows a maximum increase in the spindle region and other graded increases as found here using gamma rays. During three different 8-hr periods of the day irradiation of adult rucuca heterozygotes seemed to be equally effective in producing changed recombination values. (auth)

6503 The Effect of X-irradiation in Oxygen and in Hydrogen at Normal and Positive Pressures on Chromosome Aberration Frequency in Tradescantia Microspores. Norman H. Giles, Jr., and Alvin V. Beatty. ORNL-822, Sept. 15, 1950. 15p.

Further studies have been made on the effect of oxygen concentrations in the range 0 to 10% (at normal atmospheric pressure) on the frequency of x-ray-induced chromosomal aberrations in Tradescantia microspores. When oxygen is present in irradiated cells there is a rapid, linear increase in aberration frequency between 0 and 10% oxygen, after which the rise is more gradual. Experiments have also been performed to test the effect of pressure during irradiation. Exposures in 5 and 10% oxygen at different pressures up to 3 atm above normal produced aberration frequencies similar to those obtained in comparable partial pressures of oxygen. These and previous results indicate that oxygen increases the frequency of x-ray-induced chromosome aberrations and that the amount of oxygen present during the time of exposure determines the extent of the effect. The apparent effect of pressure in the presence of oxygen is, in reality, an oxygen effect. Experiments in which inflorescences were irradiated in pure hydrogen at normal atmospheric pressure and at 3 atm above normal pressure showed no significant decrease in interchange frequency. These results are interpreted as supporting the view that aberrations produced by x rays in the absence of oxygen may all result from a direct effect of the radiation on the chromosomes.

6504 The Effect of X-irradiation upon Fat Absorption in the Mouse. James F. Mead, Arthur B. Decker, and Leslie R. Bennett. University of California at Los Angeles. UCLA-90, Sept. 12, 1950. 21p.

Fat absorption in mice was followed using methyl oleate containing 10% of the spectrophotometrically active methyl octadecadienoate as a tracer. The rate of absorption of this mixture was shown to be nearly constant. Mice which had received 600 to 700 r whole-body x irradiation showed a tendency toward increased tone and motility of the gastrointestinal tract, resulting in retention of oil in the stomach or rapid passage past the absorbing surface. Despite these changes, fat absorption per se appeared to be about normal. A post-irradiation increase in fecal fat was shown not to be due to lowered absorption since it occurred in animals on a fat-free diet. It is concluded that there is no evidence for post-irradiation impairment of fat absorption. (auth)

6505 Action of α Rays and of Ultraviolet Light on Bacterium Coli. Hermann Engelhard and Thea Houtermans. Z. Naturforsch. 5b, 264-9(1950) July-Aug. (In German)

By combining phase-contrast microscopic observations with a counter technique, the killing effect of ultraviolet light and α radiations on Bacterium coli was determined as a function of the absolute dose. It was found that, at equal doses, the effect is independent of the radiation intensity. The survival versus dose curve falls off exponentially at small and medium doses and becomes steeper at higher

doses. In the case of ultraviolet light the curve terminates in a horizontal tail possibly reflecting the presence of bacteria resistant to ultraviolet radiations. Morphological pictures point to a many-hit radiobiological process, while the shape of the curves indicates the presence of two separate mechanisms, one of the one-hit and another of the many-hit nature. (auth)

6506 The Effect of Isotopic (I^{131}) Radiation and X-radiation on the Total Coproporphyrin Excretion in Humans. Henry J. Koch, Jr., Timothy R. Talbot, Mitchel Bernstein, Jean MacKinnon, and Catherine Elias. J. Clin. Endocrinol. 10, 1029-53(1950) Sept.

In an effort to understand the mechanism by which ionizing radiation affects the synthesis and metabolism of hemoglobin and related respiratory pigments, the excretion of coproporphyrin in the urine and feces has been studied in four patients receiving radioactive iodine, I^{131}, in two patients receiving x radiation, and in one patient to whom ACTH was administered. These observations have been correlated with studies of the peripheral blood and of liver function. Increased excretion of coproporphyrin in urine and feces has been observed in the patients receiving therapeutic doses of radioactive iodine and x radiation and in the patient receiving ACTH. A decrease in the total number of circulating lymphocytes preceded or was concomitant with this increase in all cases. Possible mechanisms for the increased coproporphyrin excretion are discussed.

6507 Experimental Histoplasmosis and X-rays. F. A. Brandt. S. African J. Med. Sci. 15, 1-4(1950) July.

Previously, deep x-ray therapy in the treatment of the fungus disease histoplasmosis was decided to be of no value. The present experiments seem to show that x-ray treatment is contraindicated. Mice, gerbils, and guinea pigs were irradiated with 800 r of x rays and shortly thereafter inoculated intraperitoneally with a South African strain of Histoplasma capsulatum. All the animals developed the acute systemic type of the disease and died. The continued application of x rays to an existing local lesion of Histoplasma seemed to increase the symptoms and duration of the lesion, and it is possible that the human condition might be similarly aggravated by the application of deep therapy. In experimental animals it seems probable that the failure to develop systemic histoplasmosis when inoculation is followed a week or more later by x-ray treatment is due to the rapid natural protective mechanisms of the animal system.

6508 Histological Changes Produced in the Epithelium of the Frog's Cornea by Total and Partial Irradiations with X-rays. G. S. Strelin. Doklady Akad. Nauk S.S.S.R. 73, 1283-6(1950) Aug. 21.

The influence of irradiated portions of tissues on the neighboring nonirradiated ones, and vice versa, was illustrated by observing the depressing action of x rays on the mitotic division in the cornea epithelium of frogs; partial irradiations were obtained by using a lead grid 0.5 mm thick as a filter. The doses used varied between 450 and 7200 r(350 r/min); the histological observations were made on material fixed at various intervals after the irradiation (up to 10 days). The results showed that partial irradiations with 3600 r produced the same effect as total irradiations with 900 r, and that at lower doses the healing

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effect of protected strips on the irradiated ones was very apparent, as was also the reverse (depressive) action at higher doses. These influences should be ascribed to chemical interactions between cells rather than to cell migrations. The foregoing observations point to possible applications of grid-shaped filters for the protection of the skin in depth therapy, as has been recommended by several authors.

6509 Benign Tumors, Nevi, and Precanceroses. Carl W. Laymon. Minnesota Med. 33, 908-9, 913(1950) Sept.

Descriptions and treatments of warts, fibromas, pigmented moles, nevi, keratoses, and precancerous lesions including radiodermatitis are given. First-degree radiation burns are characterized by erythema with slight burning and itching which disappears after a few days or weeks. In second-degree radiodermatitis there is edema, intense erythema, and vesiculation followed in a few days by exudation and erosion and crusting. There is a loss of hair which may be permanent. Months later there may be atrophy and telangiectasia with excessive dryness of the skin followed by pigmentation, the formation of keratoses, and later malignant degeneration. In third-degree acute radiodermatitis there is extreme necrosis and ulceration with extremely slow healing which may take months. In chronic radiodermatitis the skin is dry, thin, smooth, shiny, and sensitive to trauma. There may be hyper- or hypopigmentation. As the dermatitis progresses, telangiectasia, keratoses, and intense atrophy may develop. Ulceration which frequently develops into carcinoma is not uncommon. Other disorders which may be complicated by malignant change include ulcers following burns or varicosities, lupus erythematosus, and lupus vulgaris.

6510 Curative Treatment of Radiolesions Resulting from the Administration of Lethal Doses of X-rays. Jean Loiseleur and Georges Velley. Compt. rend. 231, 529-31(1950) Sept. 4. (In French)

From a brief analysis of phenomena taking place in cells following lethal doses of x rays, the hypothesis was made that prompt administration of oxygen acceptors capable of penetrating the cells and reducing the dissolved oxygen would be a curative treatment for radiation injury. Eighteen rabbits were exposed to 950 r of whole-body x irradiation, and ten of these were immediately injected intraperitoneally with 20 cc of a solution of cysteine and ascorbic acid. Additional 10-cc doses were injected after 30 min and 2 hr. Six of the ten survived, are in good health, and have gained weight 2 to 4 months after the irradiations. All the untreated controls died 5 to 28 days after receiving the irradiation.

6511 Reconstructive Surgery of the Hand and Industrial Rehabilitation. Michael L. Lewin. Ind. Med. Surg. 19, 457-61(1950) Oct.

A case report of a patient with chronic ulcerative radiodermatitis of the hand caused by overexposure to fluoroscope x radiation is included in this discussion of reconstructive surgery. Full function of the hand was restored by resurfacing the entire involved area with an abdominal tubed flap and free skin grafts. Because of the increasing use of radioactive materials in industry, it is likely that radiation injuries of this kind will become more frequent. The only

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effective treatment consists of complete eradication of involved tissues and approximate resurfacing.

6512 Reduction in Lethal Effect of X-radiation by Pretreatment with Thiourea or Sodium Ethane Dithiophosphonate. R. H. Mole, J. St. L. Philpot, and G. R. V. Hodges. Nature 166, 515(1950) Sept. 23.

A few substances, selected in the hope that they would enter cells without being too toxic or too rapidly metabolized, and would protect against radiation damage by competing for hydroxyl radicals, were administered intraperitoneally to mice a few minutes before or after x irradiation. Saline solution was used as a control. The protective effects of thiourea and dithiophosphonate were highly significant, those of glycerol barely so. Thiourea given immediately after the irradiation was ineffective, and saline was not deleterious.

6513 Monthly Report of Laboratory Activities, June 1950. New York Operations Office. NYO-1528, nd. 12p.

A summary of the New York Operations Office Health and Safety Division laboratory activities for the month of June is presented. This covers briefly the work of the Instruments Branch and Analytical Laboratory and the laboratory activities of the Radiation Branch and the Industrial Hygiene Branch.

6514 Radioactive Waste Disposal; a Bibliography of Unclassified Literature. Robert L. Shannon. Technical Information Division, ORE, AEC. TID-375, Aug. 1950. 8p.

A bibliography on various processes and methods of radioactive waste disposal has been compiled.

6515 Some Particulars on Aerosols. O. D'Agostino. Superior Inst. of Health 12, 398-416(1950). (In Italian)

Some aerosols have been prepared of ammonium chloride and of various organic substances. The aerosol was filtered through a filtering substance in such a way as not to retain all of the aerosol; the particles passing beyond this substance were completely collected by a second filter electrically isolated and connected with a device permitting control of the magnitude and sign of their prevalent charge. An attempt has been made to determine whether the electrization of the aerosol can be correlated with the structure of the substance of which it consists and to determine whether the filtering capacity of the masses used can be correlated with the formation on them of electrically active points by the passage of the aerosol, or with the structure of the substances of which the masses are composed. The effect has been studied of the increase in filtering capacity observed in various fibers, especially animal ones, as a consequence of the application of a coating of various substances, this effect being correlated with the structure of the said substances. Some hypotheses have been advanced to explain the facts thus observed. (auth)

6516 Cancer of the Thyroid. George Crile, Jr. J. Clin. Endocrinol. 10, 1152-70(1950) Sept.

In this extensive discussion of the diagnosis, classification, prophylaxis, and treatment of thyroid cancers and tumors, the use of tracer doses of I^{131} is recommended in all cases to determine whether the tumors take up iodine. Radioiodine therapy should be tried in the treatment of the more differentiated types of nonpapillary carcinoma, but it has not been

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of value with the undifferentiated tumors. Unfortunately, only about 1 in 10 cancers of the thyroid takes up significant amounts of I^{131}, and these are the low-grade tumors which usually are amenable to surgical cure and do not require any other means of therapy.

6517 The Clinical Use of Radioactive Isotopes. John Hundale Lawrence. Bull. N. Y. Acad. Med. 26, 639-69(1950) Oct.

Some investigations carried out at the Donner Laboratory of Medical Physics, University of California, with isotopes, particularly with H^3, C^{14}, P^{32}, Fe^{59}, and I^{131}, are reviewed as examples of the use of isotopes in the study and treatment of disease. Studies in blood-volume determination, iron metabolism, and radioisotope therapy in the treatment of leukemia, pernicious anemia, polycythemia vera, tumors, and cancers are discussed. Also mentioned are blood circulation studies with radioactive krypton and Na^{24}, the pile-activation technique for measuring trace amounts of elements in tissue samples, and studies on the metabolism of organic compounds. 37 references.

6518 The Distribution of Radioactive Iodine in Human Tissues: Necropsy Study in Nine Patients. J. B. Trunnell, B. J. Duffy, Jr., John T. Godwin, Wendell Peacock, Lorraine Kirschner, and Ruth Hill. J. Clin. Endocrinol. 10, 1007-21(1950) Sept.

Nine patients dying after (although with one exception not because of) radioactive iodine administration have been studied with respect to their tissue iodine distribution. Both direct gamma-ray measurement and radioautographic procedures were employed. Data obtained have been presented in tabular form and have been used as a basis for estimating quantities of radiation which may be delivered to various tissues as a result of therapy with I^{131}. Only the corpora amylacea of the prostate of one patient showed iodine collection radioautographically in nonthyroid or nonthyroid-cancer tissue. Reasons for inability to regard this group of patients as representative of normal are set forth. (auth)

6519 An Evaluation of the Nature, Treatment, and Prognosis of Leukemia. Cyrus C. Sturgis. Proc. Inst. Med. Chicago 18, 158-69(1950) Oct. 15.

Every year more than 5000 deaths occur in the United States from leukemia, and the incidence and mortality rate of this disease are steadily increasing. A general evaluation of the pathology of the disease, the influence of heredity, x-ray exposure as a cause, treatment, including roentgen-ray and P^{32} therapy, and the present outlook for an improved prognosis is given.

6520 An Evaluation of Radioactive Iodine Therapy in Metastatic Thyroid Cancer. Virginia Kneeland Frantz, William G. Larsen, and Alfred Jaretzki III. J. Clin. Endocrinol. 10, 1084-91(1950) Sept.

The authors briefly summarize their experiences with 225 cases of thyroid cancer, 104 of which have had a 10-yr follow-up. Special attention is paid to the case studies of four patients treated with massive doses of I^{131} for advanced follicular carcinoma (malignant adenoma) of the thyroid. After a 2-yr period, it can be said that at least palliation has been effected; that two of the patients who were bedridden were made ambulatory; that two patients with pain, who had had x-ray therapy to and beyond the limit of skin tolerance, were

further irradiated by I^{131} with symptomatic improvement; and that no striking progression of disease has occurred in these patients, whereas progression might have been anticipated on the basis of past experience with other cases of bone lesions not so treated. It is possible that the apparent arrest is due in part to the removal of the thyroid gland, and the treatment of the induced hypothyroidism by thyroid medication, which eliminates the stimulating effect of the pituitary on the metastases. Whether the functional stimulation might be accompanied by acceleration of growth of the malignant neoplasm is a matter for speculation. All of these factors must be evaluated in further study, but at present the authors think that this therapy is sufficiently promising to warrant such study in cases of advanced metastatic disease.

6521 An Evaluation of Radioactive Iodine in the Treatment of Hyperthyroidism. R. H. Moe, E. E. Adams, J. H. Rule, M. C. Moore, J. E. Kearns, Jr., and D. E. Clark. J. Clin. Endocrinol. 10, 1022-8(1950) Sept.

One hundred cases of hyperthyroidism treated with radioactive iodine are presented, and the method of treatment is discussed. Other than instances of hypothyroidism, no complication resulting from the administration of radioactive iodine has been observed. There has been no radiation sickness and no evidence of bone marrow depression or injury to the parathyroids or kidneys. Increase in exophthalmos has not been observed and a definite improvement has been noted in a few cases. The incidence of hypothyroidism and myxedema (12%) is within the range observed by other groups using I^{131} and is comparable to that following surgery. These results suggest that radioiodine is a valuable agent in the treatment of selected cases of hyperthyroidism.

6522 Preparation of Radioactive Glass Beads. Walter Kisieleski, George Svihla, and Austin M. Brues. Science 112, 400-02(1950) Oct. 6.

The production of glass beads containing Y^{91}, Ce^{144}, or Sr^{90} is described. Means of selection and calibration of various bead sizes are included. Beads have been produced with specific activities ranging from 0.005 to 1.5 mc/mg, having diameters ranging from 0.05 to 1.0 mm, and weighing up to 1 mg. There are many possible experimental uses for these small, intensely radioactive sources that can, for example, be imbedded in living tissue.

6523 Radioactive Iodine in the Treatment of the Hyperthyroidism of Nodular Goiter. Charles E. Richards, George Crile, Jr., and E. Perry McCullagh. J. Clin. Endocrinol. 10, 1077-83(1950) Sept.

Some clinical observations on 37 cases of hyperthyroidism in nodular goiter and the results of treatment with radioactive iodine have been presented. Thirty-two patients have had remissions of their disease following the administration of varying amounts of this isotope. Five patients followed six months or longer did not have a remission when last seen. (auth)

6524 Radio-Iridium Teletherapy. H. F. Freundlich, J. L. Haybittle, and R. S. Quick. Acta Radiol. 34, 115-34(1950) July-Aug.

The possibilities of Ir^{192} as a source of γ rays for teletherapeutic units have been investigated, and the design of a complete unit is described. An output of about 11 r/min at 8 cm skin-focus distance is obtained from a unit weighing approximately 50 lb which nevertheless has sufficient lead protection to make pneumatic control unnecessary. Measurements of protection, absorption, and dose distribution have been made. Future developments leading to improved design and increased output are discussed. (auth)

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6525 Some Notes on the Role of Research in the Development of the Modern Treatment of Exophthalmic Goiter. Samuel F. Haines. J. Clin. Endocrinol. 10, 989-95(1950) Sept.

A brief general review of developments in the treatment of Graves' disease is presented. The history of the application of radioisotopes to this disease is very briefly summarized.

6526 Some Results of the Million-Volt X-ray Therapy in the U.S.A. Heinrich Chantraine. Roentgen Blaetter 3, 245-9(1950) Sept. 1. (In German)

The supervoltage therapy has not yet been used in Germany. A short account is given of the present-day experience in the United States. Although no specific action of extra-hard rays on the tumor is observed, their main advantages over the usual less than 200-kv techniques are greater depth effects and a better protection of neighboring tissues and of the skin.

6527 Toxicological Studies of Certain Thorium Salts. Paul A. Mattis. NYO-1607, June 8, 1950. 47p.

The results of studies designed to determine the toxic manifestations following the administration of soluble thorium salts by various routes are presented. Experiments on methods for the detection of microgram quantities of thorium in biological material are described. The acute toxicology of thorium nitrate or thorium chloride following oral, intraperitoneal, intravenous, or subcutaneous administration is given. The results of feeding thorium nitrate to rats during most of their life span are presented. The distribution of thorium in the body as determined by the use of the thorium isotope UX_1 (Th^{234}) is indicated. A tolerance figure for thorium in man is estimated. (auth)

6528 Further Observations on the Pathological Physiology of Chronic Granulomatosis Associated with Beryllium Workers. Robert A. Bruce, Frank W. Lovejoy, Jr., Nan Gan Yu, and Raymond Pearson. UR-118, May 18, 1950. 33p.

Three more cases of chronic pulmonary granulomatosis associated with beryllium compounds have been studied with reference to pulmonary and circulatory functional capacity. Despite obvious variations in clinical patterns of disease between patients, certain nonspecific general trends of functional disturbance appear common to most of these patients. They are restricted complemental air volume, increased mid-capacity-arterial oxygen gradient, hypoxemia, and hyperventilation on exertion. The complexity of factors contributing to the widened oxygen gradient are discussed. A general quantitative estimate of disability in relation to moderate exercise is expressed in terms of the physical fitness index. Untoward responses to continuous oxygen therapy are recorded. (auth)

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6529 An Adverse Effect of BAL in a Case of Subacute Arsenical Polyneuritis, with Observations on Porphyrin Metabolism. James H. Sands, Barnet Berris, and L. Raymond Scherer. New Engl. J. Med. 243, 558-61(1950) Oct. 12.

A case of arsenical polyneuritis treated with British antilewisite is presented. Marked aggravation of neurologic symptoms and signs followed the administration of BAL in the usual dosage. This is believed to be the first report of such an adverse response to BAL during treatment of arsenical poisoning. Possible explanations for this response are considered. Serial urinary arsenic and coproporphyrin studies are described. The urinary Type III coproporphyrin excretion was markedly elevated, and the erythrocyte protoporphyrin considerably elevated. BAL therapy caused a slight increase in the urinary excretion of arsenic and coproporphyrin, although the findings were not conclusive. (auth)

6530 Berylliosis. Brief Discussion and Presentation of a Case with Pulmonary, Digital, and Axillary Node Involvement. Robert A. Nachtwey, Malcolm B. Dockerty, and Corrin H. Hodgson. Minnesota Med. 33, 904-07, 929(1950) Sept.

A review of the clinical aspects of berylliosis, including the dermatologic and respiratory manifestations, the forms of pneumonitis due to beryllium exposure, and the pathology of the disease, is given. It is followed by a case study of a patient with typical beryllium pneumonitis, a "healed" beryllium ulcer of the finger, and an associated axillary lymph node from which beryllium was recovered and identified by spectrographic analysis.

6531 A Mechanism for Fluoracetate Inhibition. W. B. Elliott and George Kalnitsky. J. Biol. Chem. 186, 487-93(1950) Oct.

It has been postulated that the toxicity of fluoroacetate is due to competitive inhibition of acetate oxidation. Since this hypothesis does not explain some of the enzymatic effects obtained, it has been suggested that the inhibitory compound is actually fluorocitrate. The formation of a fluorocitrate was demonstrated by incubating rabbit kidney cortex tissue, oxalacetate, and fluoroacetate, adding normal citrate as a carrier after deproteinization, and demonstrating the presence of fluoride ion in the isolated citrate and in the pentabromoacetone fraction obtained from the citrate.

6532 The Absorption of Phosphate from the Subarachnoid Space. Jacob Sacks and George G. Culbreth. Brookhaven National Laboratory and Johns Hopkins Hospital. AECU-960, nd. 1p.

This report is reproduced in its entirety.

A comparison has been made of the time-courses of the relative specific activities (r.s.a.) of the plasma inorganic phosphate in cats for the first 4 hr after intravenous and intracisternal injection of tracer phosphate, and of the r.s.a. of the inorganic, phosphocreatine, and ATP phosphorus of brain and muscle at the end of this period. The highest r.s.a. of the plasma phosphate following the intracisternal injection was found in samples of carotid blood taken 30 min after the injection. The subsequent course of the r.s.a. indicates that approximately 2/5 of the tracer material injected does not appear in the plasma within the 4-hr period. The r.s.a. of the P fractions of the brain in these animals was generally higher than that of the final plasma samples.

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The r.s.a. of the phosphocreatine and ATP P of the muscles of the animals which received the tracer intracisternally was about 2/5 as great as in the animals in which the tracer was injected intravenously. The r.s.a. of these compounds in the brain was significantly higher than in the muscles of the animals in which the tracer was injected intravenously.

6533 The Relation of Photosynthesis to Respiration. John W. Weigl. UCRL-590, Apr. 27, 1950. 142p.

The gas exchange by barley seedlings of O_2, CO_2, and added $C^{14}O_2$ has been measured in a closed system, with the following results. The carbon of newly formed photosynthetic intermediates is not available for respiration while the light is on but becomes immediately respirable in the dark. The enhancement of dark respiration after a light period is very probably due to the build-up "photosynthates." Photosynthesis proceeds at a measurable rate even at the lowest CO_2 pressures observed (0.03 mm Hg). There is no evidence for a "threshold" concentration of carbon dioxide for the reaction. At the lowest concentrations reached, respiration just equals assimilation, so that a CO_2-steady state ensues. A curve showing the dependence of the rate of photosynthesis on partial pressure of CO_2 yields a "Michaelis constant" of 0.79 mm Hg; this corresponds to a free energy of carboxylation of −5700 cal/mole. The mean rate of respiration in strong light is about half that in the dark. Re-assimilation of respiratory carbon dioxide probably accounts for part, but not all of this effect. At low CO_2 pressures, molecular oxygen may be able to substitute for carbon dioxide as the oxidant of photochemically generated reducing agents. The assimilation of $C^{14}O_2$ is about 17% slower than that of $C^{12}O_2$. Backscattering appreciably raises the observed β-activity from thick samples containing C^{14}. The true self-absorption of carbon-radioactive organic materials is the same as that of $BaC^{14}O_3$. (auth)

6534 The Path of Carbon in Photosynthesis. X. Carbon Dioxide Assimilation in Plants. M. Calvin, J. A. Bassham, A. A. Benson, V. Lynch, C. Ouellet, L. Schou, W. Stepka, and N. E. Tolbert. UCRL-658, Apr. 1, 1950. 51p.

The conclusions which have been drawn from the results of $C^{14}O_2$ fixation experiments with a variety of plants are developed in this paper. The evidence for thermochemical reduction of carbon dioxide fixation intermediates is presented and the results are interpreted from such a viewpoint. The relative rates of appearance of the first observed products of carboxylation reactions of photosynthesis (phosphoglycerate and malate) have been shown to be dependent on experimental conditions. The cyclic sequence of reactions required for regeneration of the postulated C_2 carbon dioxide acceptor is discussed in the light of accumulated evidence. Such evidence obtained from degradation of probable intermediates is tabulated. Respiration and photosynthesis have been found interrelated. There are compounds common to both systems. Light has an inhibitory effect upon respiration of immediately previously formed intermediates of hexose synthesis. This effect has been recognized as a function of light intensity. It has also been shown to be pertinent to acetate metabolism in algae. Preliminary observations on the effects of inhibitors and abnormal conditions upon the course of carbon dioxide fixation are interpreted on the basis of present information. (auth)

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6535 The Metabolism of Radioactive Cobalt (Co^{60}) in Normal and Alloxan-Diabetic Rats. Frank Ulrich and D. Harold Copp. UCRL-839, Aug. 10, 1950. 13p.

A study was made of the distribution of Co^{60} in various tissues and organs of normal and alloxan-diabetic rats during the first 24 hr following injection. No significant statistical differences were observed between the two groups of animals. Radioautographs of the pancreas in the two groups failed to provide any evidence that the cobalt in this organ might be concentrated in the islets of Langerhans. (auth)

6536 An Appraisal of the Radioiodine Tracer Technique as a Clinical Procedure in the Diagnosis of Thyroid Disorders. Uptake Measurement Directly over the Gland and a Note on the Use of Thyrotropin. Sidney C. Werner, Howard B. Hamilton, Edgar Leifer, and Lawrence D. Goodwin. J. Clin. Endocrinol. 10, 1054-76(1950) Sept.

Data from about 1400 tracer tests of thyroid function have been analyzed. Uptake of radioiodine, I^{131}, was measured directly over the gland 24 hr after ingestion of a tracer dose of 40 μc. A comparison of various tracer methods has been made from the standpoint of clinical usefulness in terms of simplicity, rapidity, and accuracy. The 24-hr uptake technique has seemed most suitable for routine diagnostic and range-finding purposes. The limitations of tracer dosage and of repetition of dosage have been discussed. A range of normal uptake of 10 to 40% at 24 hr has been established and includes 90% of all euthyroid individuals. A small but significant overlap with hyperthyroid and hypothyroid subjects has been observed. The sources of error in tracer techniques, such as the preceding administration of desiccated thyroid or inorganic and organic compounds containing iodine are reviewed. A limited comparison between the results from the tracer technique and those from the serum precipitable iodine and basal metabolic rate determinations has been made. The use of two or more such tests results in a high degree of accuracy of diagnosis (95%, approximately) but still admits the definite possibility of error. Anterior pituitary thyrotropin administration has been investigated as a method for differentiation between primary hypothyroidism and hypopituitarism. It appears to be a useful tool. The measurement of a single function of the thyroid, no matter how precise, is not completely reliable as an index of the state of thyroid activity. Erroneous conclusions may be drawn even when several functions of the gland are tested. Sound clinical judgment is still the final arbiter in the diagnosis of thyroid disease. (auth)

6537 The Biosynthesis of Nucleic Acid Components Studied with C^{14}. I. Purines and Pyrimidines in the Rat. Milton R. Heinrich and D. Wright Wilson. J. Biol. Chem. 186, 447-60(1950) Oct.

The biological synthesis of purines and pyrimidines in rats was studied by administering precursors labeled with radioactive carbon, C^{14}. Adenine, guanine, uracil, and thymine were isolated from tissue nucleic acids, and adenine was isolated from nucleotides. Guanine and uracil were degraded to determine the position of the isotope within the molecule. Carbon dioxide was found to contribute to carbon 6 of guanine, glycine contributed its carboxyl

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carbon to carbon 4 and its α-carbon to carbon 5, and formate was incorporated into positions 2 and 8. While CO_2 was incorporated into position 6 of the purines, it entered at a similar rate into position 2 of uracil, that is, the ureide carbon. This constitutes a new reaction for the fixation of CO_2 in a compound necessary for the body. (auth)

6538 The Biosynthesis of Radioactive Fatty Acids and Cholesterol. Roscoe O. Brady and Samuel Gurin. J. Biol. Chem. 186, 461-9(1950) Oct.

The utilization of carboxyl- and methyl-C^{14}-acetic acid, β-C^{14}-pyruvic acid, and carboxyl-C^{14}-butyric, hexanoic, and octanoic acids by rat liver slices for the biosynthesis of long-chain fatty acids has been investigated. The long-chain fatty acids derived from carboxyl-labeled octanoate appear to contain C^{14} in alternating carbon atoms throughout the molecule. These results suggest that the synthesis of long-chain fatty acids from short-chain acids occurs, to a large degree, by fragmentation of these acids to 2-carbon units which are subsequently recombined to form long-chain fatty acids.

6539 Blood Exchange in Replacement Transfusions. II. Studies with Erythrocytes Tagged with Radioactive Phosphorus. L. R. Wasserman, I. A. Rashkoff, L. Sharney, T. F. Yoh, and D. Leavitt. Blood 5, 938-49(1950) Oct.

Red cells labeled with radiophosphorus, P^{32}, have been used to measure blood volumes and the extent and rate of replacement of blood in exchange transfusions. The experimental results have confirmed the theoretical formulations developed by Wasserman and Sharney (Blood 5, 925-37(1950)). It would seem reasonable to introduce these curves and formulas whenever exchange transfusions are to be performed.

6540 Chromatographic Separation of Radiophosphorus Fractions of Milk. Joseph Sternberg and Germaine Demaux. Compt. rend. 231, 524-6(1950) Sept 4. (In French)

The phosphorus compounds of milk are closely bound up in the colloidal system of the casein micelle as phosphoserine, phospholipids, free ions, or phosphate bound to the amine groups of lysine. This complexity explains the difficulty previously encountered in separating the various phosphorus fractions. A quantitative separation of the P^{32}-labeled phosphorus components is shown to be accomplished at a pH of 7.00 to 7.50 in an aluminum oxide hydrate ion exchange column.

6541 Deuteroacetate in the Biosynthesis of Ergosterol by Neurospora. Robert C. Ottke, Sofia Simmonds, and E. L. Tatum. J. Biol. Chem. 186, 581-9(1950) Oct.

The incorporation of deuteroacetate into Neurospora mycelium, fat, and sterol has been followed by using the wild-type strain and a mutant strain which requires acetate for growth. The results prove that acetate metabolism in the mold resembles that in the rat in that acetate is the principal precursor for fat and sterol synthesis. The infrared spectra of ergosterol isolated from Neurospora grown on deuteroacetate and on normal acetate in heavy water show distinct and different absorption peaks, especially in the

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region of the carbon-deuterium bond-stretching frequencies, showing that the location of the deuterium in the sterol molecule differs in the two cases. (auth)

6542 The Effects of Hypophysectomy, Growth, and Adrenocorticotropic Hormones on the Incorporation of P^{32} into Liver Phospholipids. Irving I. Geschwind, Choh Hao Li, and Herbert M. Evans. Endocrinology 47, 162-5(1950) Sept.

The uptake of phosphorus by rat liver phospholipids has been investigated by intraperitoneal injection of P^{32}-labeled Na_2HPO_4 solution. Ageing causes a decrease in the uptake of P^{32} by liver phospholipids. Hypophysectomy, with or without growth or adrenocorticotropic hormone treatment, does not influence the concentration of phospholipids in liver, but does result in a decreased turnover of liver phospholipids. Growth hormone produces an increase in the turnover of liver phospholipids in normal or hypophysectomized rats. Treatment of the hypophysectomized animal with ACTH results in an increased turnover of liver phospholipids.

6543 Enzymic Oxidation of Formic Acid. Martin B. Mathews and Birgit Vennesland. J. Biol. Chem. 186, 667-82(1950) Oct.

The enzyme system from green peas which catalyzes the reduction of dyes by formate has been shown to consist of two separate factors. One of these, formic dehydrogenase, catalyzes the reduction of diphosphopyridine nucleotide (DPN) by formate; the other catalyzes the oxidation of reduced DPN by methylene blue. Both enzymes have been partially purified. The properties of the formic dehydrogenase have been studied, particularly with reference to the possible reversibility of the reaction catalyzed. The reduction of $C^{14}O_2$ to formate by reduced DPN was found to occur only to an insignificant extent.

6544 Incorporation of the Carbons of Acetone, Formate, and Carbonate into Acetoacetate. G. W. E. Plaut and Henry A. Lardy. J. Biol. Chem. 186, 705-16 (1950) Oct.

The mechanism of the metabolism of C^{14}-labeled acetone, formate, and carbonate in rat liver slices has been studied. It was demonstrated that the C^{14} was incorporated into acetoacetate. The effect of pyruvate, malonate, and biotin on the process is discussed.

6545 Insulin and Hepatic Utilization of Glucose for Lipogenesis. S. S. Chernick and I. L. Chaikoff. J. Biol. Chem. 186, 535-42(1950) Oct.

The effects of previous insulin injections, in normal and alloxan-diabetic rats, upon the capacity of their livers to convert added C^{14}-labeled glucose to fatty acids and CO_2 were studied. The livers of the alloxan-diabetic rats converted little or none of the added C^{14}-glucose to fatty acids. Pretreatment of such rats with insulin for 1 to 5 days completely repaired this defect in utilization of carbohydrate for lipogenesis. Insulin injections also caused a pronounced increase in the capacity of the normal and diabetic livers to oxidize added C^{14}-glucose to CO_2.

6546 Iodine Compounds in the Blood and Urine of Man. J. E. Rall. J. Clin. Endocrinol. 10, 996-1006(1950) Sept.

The thyroxine-like, diiodotyrosine-like, and iodide fractions in the blood of 8 hyperthyroid, 5 euthyroid, and 3 myxedematous patients given radioiodine, I^{131}, were determined by radioactive analysis. The major constituent of the serum radioiodine under these conditions was thyroxine-like in nature, in most of both the euthyroid and hyperthyroid patients. The organic radioiodine compounds were studied in the urine of hyperthyroid, euthyroid, and myxedematous patients after administration of radioiodide. In hyperthyroid patients, by the third day after ingestion, from 12 to 40% of the urinary radioiodine was present in organic form. In the euthyroid patients, by the third day after the administration of radioiodine, less than 2% of the total urinary radioiodine was in the form of organic iodine compounds. Further studies on the organic iodine compounds by means of butanol, alkali, and silver solubilities demonstrated the presence of thyroxine-like and diiodotyrosine-like fractions in the urine of both euthyroid and hyperthyroid patients. That thyroxine was present as part of the organic urinary iodine was also suggested by recrystallization techniques and filter paper partition chromatography. (auth)

6547 Lipogenesis and Glucose Oxidation in the Liver of the Alloxan-Diabetic Rat. S. S. Chernick, I. L. Chaikoff, E. J. Masoro, and Eugenia Isaeff. J. Biol. Chem. 186, 527-34(1950) Oct.

The conversion of C^{14}-labeled glucose to fatty acids and CO_2 was studied in surviving liver slices prepared from normal and alloxan-diabetic rats. It is concluded that glucose utilization is impaired in the diabetic liver.

6548 Net Production of Serum Albumin by Liver Slices. Theodore Peters, Jr., and Christian B. Anfinsen. J. Biol. Chem. 186, 805-13(1950) Oct. (See also NSA 4-2983)

Direct observation of protein synthesis in vitro is made difficult by the fact that the total protein content of tissue slices decreases upon incubation, owing to the predominance of proteolytic reactions. An immunological technique has been developed by which small amounts of serum albumin in chicken liver slices and their incubation media can be determined. Investigations were made of the effect on albumin production of variations in the ionic composition of the incubation medium and of addition to the medium of inhibitors, substrates, and hormones. Demonstration of incorporation of large amounts of $C^{14}O_2$ into the dicarboxylic amino acids of this albumin is evidence that the observed appearance of albumin actually represents the formation of new protein.

6549 The Oxidation of Acetate-1-C^{14} by Rat Tissue in Vitro. Arthur B. Pardee, Charles Heidelberger, and Van R. Potter. J. Biol. Chem. 186, 625-35(1950) Oct.

A study of the oxidation of acetate-1-C^{14} by slices and by homogenates of rat tissues has been carried out. The $C^{14}O_2$ output of slices in the presence of labeled acetate is considered to be the best available criterion of acetate oxidation, but a number of limitations of both homogenates and slices are pointed out.

6550 P^{32} in Nucleotides of Nuclear Pentosenucleic Acid of Rabbit Liver. Alfred Marshak and Henry J. Vogel. J. Cellular Comp. Physiol. 36, 97-104(1950) Aug.

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Following intravenous injection of radioactive phosphate, more than 90% of the P^{32} in the pentosenucleic-acid-containing fraction of rabbit liver nuclei may be accounted for in nucleotides. At 3 hr after P^{32} administration, the specific activities of adenylic and guanylic acids and the mixture of uridylic and cytidylic acids are all approximately the same. There is no change in the relative specific activity of any of the nucleotides between 3 and 24 hr after the P^{32} administration. The rates of turnover of P^{32} in each of the nucleotides are, therefore, the same within the limits of error of the experiment. The significance of this finding is discussed in relation to the hypothesis that the nucleus contains a nucleoprotein which acts as a precursor to cytoplasmic pentosenucleic acid. (auth)

6551 The Pool of Miscible Uric Acid in Normal and Gouty Man, Studied with the Aid of Isotopic Nitrogen. DeWitt Stetten, Jr. J. Mt. Sinai Hosp. N. Y. 17, 149-58(1950) Sept.-Oct.

Stable N^{15}-labeled uric acid has been synthesized and used to study the magnitude, turnover rate, and isotopic concentration of the miscible pool of uric acid in normal and gouty adult men.

6552 Potassium Metabolism in Escherichia Coli. III. Interrelationship of Potassium and Phosphorus Metabolism. Richard B. Roberts and Irena Z. Roberts. J. Cellular Comp. Physiol. 36, 15-39 (1950) Aug. (See also NSA 4-2249)

The effects of potassium depletion have been studied in E. coli, using K^{42} tracer. The rates of synthetic processes including growth, incorporation of sulfur, S^{35}, into proteins, and the incorporation of phosphorus, P^{32}, into phospholipids and nucleic acids are shown to depend on the content of bound potassium in the cell. The extent to which potassium depletion affects the uptake of phosphorus by the cell depends on the conditions of the experiment. Factors found to be important include the duration of the experiment, pH of the medium, the energy source, and the state of adaptation of the cells. When hexose phosphates are used as the energy source most of the phosphorus found in the nucleic acids is derived from the phosphorus of the hexose phosphate. This indicates that these intermediates are utilized mainly by an oxidation process leading to pentose phosphate. Potassium does not appear to be necessary for oxidation but is required in the anaerobic reaction sequence. (auth)

6553 The Sedimentation Differential Agglutination Test. I. Method of the Test. II. Observations on the Destruction and Production of Red Blood Cells, with Special Reference to Myeloblastic Leukemia and Comparison with the Results of the Radioactive Phosphorus Method. Daniel Stats. Blood 5, 950-63 (1950) Oct.

The sedimentation differential agglutination technique is a modification of the Ashby method by means of which the concentration of immunologically distinct erythrocytes in a mixture can be determined by observing their volume after agglutination and subsequent sedimentation. The method has been applied to the determination of the efficiency of replacement transfusions and the survival of red cells after blood transfusion, and has afforded a method for the determination of production of erythrocytes under certain conditions. The results indicate an almost complete inhibition of erythropoiesis and the frequent presence of excessively rapid hemolysis in "blast" leukemias. In a number of instances in which simultaneous measurements by the sedimentation differential agglutination and radioactive phosphorus, P^{32}, techniques were made, good correspondence between the two methods was observed. (auth)

6554 Studies on Urea Formation in Surviving Liver Slices. C. H. W. Hirs and D. Rittenberg. J. Biol. Chem. 186, 429-45(1950) Oct.

An investigation with the aid of N^{15} of the ornithine cycle in the surviving rat liver slice system is reported. N^{15}-α- and δ-labeled l-ornithine and N^{15}-carbamyl-labeled l-citrulline have been synthesized. The use of α- and δ-labeled ornithine has demonstrated that in this system the function of this amino acid is almost exclusively catalytic. The amino groups contribute directly to urea formation to a negligibly small extent. The use of N^{15}-carbamyl-labeled citrulline provides further evidence that this amino acid is an intermediate in the conversion of ornithine to arginine. Experiments with N^{15}-amide-labeled glutamine have indicated that no specific function is attributable to the amide nitrogen of glutamine in the urea-forming process in this system. It has been shown that in liver slices ammonia nitrogen is much more efficiently used for urea formation than the amino nitrogen of glutamic acid, aspartic acid, and alanine. However, the nitrogen for urea formation can, at least in part, be derived directly from the amino group of aspartic acid. Glutamic acid and glycine can contribute to this process. Evidence is presented that aspartic acid and glutamic acid penetrate the liver cell in this system. (auth)

6555 Studying 2,4-D with Radioactive Tracers. Robert W. Holley and Frank P. Boyle. Farm Research 16, No. 6, 2(1950) Oct. (See also NSA 4-4553)

Radioactive 2,4-D (2, 4-dichlorophenoxyacetic acid) was prepared containing radioactive carbon, and this 2,4-D was used to determine the behavior of the ordinary weedkiller. This 2,4-D is so radioactive that 0.1% of the amount used to treat a single plant is easily detected by the Geiger counter. In one experiment, several young red kidney bean plants, which were grown under controlled conditions, were treated by placing a small amount of radioactive 2,4-D on one leaf of each plant. After various time periods, the plants were cut up and the parts were dried. The carbon present in each part was converted to carbon dioxide and this was changed to barium carbonate. The distribution of radioactive carbon in the plants is shown schematically. At the end of seven days, the radioactive material present in a group of treated plants was isolated and the chemical identity of the material was studied. About one-third was proved to be unchanged 2,4-D. The remainder of the 2,4-D which had been absorbed had been altered chemically by the plant.

6556 The Synthesis of l-Ascorbic Acid by the Albino Rat. S. S. Jackel, E. H. Mosbach, J. J. Burns, and C. G. King. J. Biol. Chem. 186, 569-79(1950) Oct.

Ascorbic acid synthesis by chloretone-treated rats has been investigated by means of radioactive C^{14} tracer techniques. In the course of this investigation radioactive ascorbic acid was prepared biosynthetically, and methyl-labeled chloretone was synthesized by the Grignard reaction. The total transfer of C^{14} from glucose to ascorbic acid

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within 24 hr was approximately equivalent to the total conversion of dietary carbohydrate to ascorbic acid calculated by weight. Partial degradation studies of the biosynthetic ascorbic acid provided evidence that the glucose carbon chain can be utilized for ascorbic acid synthesis, without changing the ratio of activity in positions 1 or 2 to the total activity.

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6557 Inorganic Per-Acids. Part II. The Alkali Percarbonates. J. R. Partington and A. H. Fathallah. J. Chem Soc., 1934-43(1950) July.

The contradictory experimental work on the alkali percarbonates has been reinvestigated. The new compounds $CsOOH.H_2O_2$, $KHCO_4$, $RbHCO_4$, $Rb_2C_2O_6$, and $Li_2CO_4.H_2O$ were obtained. The compounds $NaHCO_4$, NaC_2O_6, $K_2C_2O_6$, $K_2CO_4 \cdot 2\frac{1}{2}H_2O$, $K_2CO_4.H_2O_2.1\frac{1}{2}H_2O$, $K_2CO_4.2H_2O_2.H_2O$, $Rb_2CO_4.2\frac{1}{2}H_2O$, $Rb_2CO_4.H_2O_2.2H_2O$, $Rb_2CO_4.2H_2O.H_2O$, and $Cs_2CO_4.H_2O_2.H_2O$ were confirmed. The supposed isomeric compounds $Na_2CO_4.1\frac{1}{2}H_2O$ and $Na_2CO_3.H_2O_2.\frac{1}{2}H_2O$ were shown to be identical. The compounds $Na_2C_2O_6.H_2O_2$ and $Na_2C_2O_6.C_2H_5OH$ were not confirmed. The validity of the Riesenfeld test for differentiating between true percarbonates and carbonates with hydrogen peroxide of crystallization is denied.

6558 Orthoesters of Silicon, Titanium, and Zirconium. W. Wardlaw and D. C. Bradley. Research 3, 462-5 (1950) Oct.

The chemistry of the esters of silicon and titanium and the industrial utilization of these compounds are reviewed. Some of the recent work on the preparation and properties of zirconium orthoesters is outlined. 24 references.

6559 Some Properties of Sodium Borohydride Solutions. E. D. Marshall and R. A. Widing. Carbide and Carbon Chemicals Division, UCCC, K-25. AECD-2914, June 30, 1950. Decl. Sept. 25, 1950. 26p.

Sodium borohydride ($NaBH_4$) has been suggested as a possibly useful reducing agent for analytical purposes, because of its stability in aqueous alkaline solutions at room temperature and because it is readily and completely decomposed in boiling or acid solutions. Some of the properties of sodium borohydride solutions were therefore investigated to determine the feasibility of using this reagent to replace the Jones reductor in the volumetric determination of uranium, and in other procedures involving the reduction of cations. Polarographic and volumetric data are given to show that uranium(VI) is reduced by sodium borohydride in alkaline complexing media and that copper(II) is reduced in ammoniacal media, whereas cadmium(II), zinc(II) and silver(I) are not reduced. Lead(II), chromium(VI) and thallium(I) are not reduced in 1M sodium hydroxide medium. Sodium borohydride exhibits two anodic polarographic waves in alkaline media. The wave at −0.15 volt versus the saturated calomel electrode is 65 times the magnitude of the wave at −0.64 volt.

6560 Spectrographic Analysis for Hafnium in Zirconium Oxide. D. D. Smith and E. J. Spitzer. Oak Ridge National Laboratory, Y-12 Area. AECD-2924, Mar. 24, 1950. Decl. Oct. 2, 1950. 10p.

An analytical procedure for quantitatively determining the amount of hafnium present in zirconium oxide is presented. Uniform and reproducible burnings are attributed to an added

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buffer of barium fluoride and powdered graphite. The hafnium 2820-A line has been densitometered at a concentration of 65 ppm. The accuracy claimed for this method of analysis is 10 to 20% of the amount of hafnium present in the concentration range below 0.5% and above 0.01%. (auth).

6561 Spectrochemical Analysis of Zirconium Oxide. D. D. Smith and E. J. Spitzer. Oak Ridge National Laboratory, Y-12 Area. AECD-2947, July 12, 1950. Decl. Oct. 4, 1950. 9p.

A spectrochemical method is presented for the quantitative analysis of zirconium oxide for 22 impurities. Silver chloride is used as a carrier in a pyro-electric type arcing procedure. One part per million of many impurities can be determined by visual comparison to an accuracy of ±50% of the element present. (auth)

6562 Identity and Instability of the Beryllium-Sulfosalicylate Complex. H. V. Meek and Charles V. Banks. ISC-81, nd. 37p.

This document previously appeared as AECU-847 and was abstracted in Nuclear Science Abstracts as NSA 4-4821.

6563 The Colorimetric Determination of Impurities in Titanium Metal. Iron and Manganese. J. A. Corbett. Analyst 75, 475-80(1950) Sept.

The colorimetric methods for the determination of iron by thiocyanate and of manganese by oxidation to permanganate are applied to the direct determination of these metals in metallic titanium, and the conditions for their adaptation to the photoelectric absorptiometer are specified. The procedures described are applicable to amounts below 2.0% for both metals, with a precision of ±2% for iron and ±1.0% for manganese. (auth)

6564 Electromigration on Filter Paper. Kurt A. Kraus and Gilbert W. Smith. J. Am. Chem. Soc. 72, 4329-30(1950) Sept. (Communication to the editor)

Filter paper electromigration was found to be a rapid method for the determination of the sign of the charge of complex ions and for obtaining estimates of the stability constants of complexes. The technique consists of the following. A strip of filter paper (E.D. No. 627-030; dimensions 11 by 3 inches) is moistened with the supporting electrolyte and the excess is blotted off. A number of one-microliter aliquots of solutions of the ions in question are placed near the center of the paper and the displacement (spot test developing) is measured after applying a known d-c voltage for a known period of time.

6565 The Use of Tannin in Chemical Analysis. L. L. Colin. J. Chem. Met. Mining Soc. S. Africa, 314-19(1950) June.

Methods for the use of tannin in the following are reported: the analysis of tantalo-niobates, the determination of uranium in radioactive ilmenites and complex minerals, the separation of titanium from vanadium, and the determination of vanadium in roscoelite. Tannin is found to precipitate uranium from alkaline solution as a brown flocculent precipitate which can be filtered off very readily. Under certain circumstances, tannin quantitatively separates uranium from titanium. Diagrammatic procedures are included.

6566 Some Observations of the Epitaxy of Sodium Chloride on Silver. G. W. Johnson. AECU-754, Dec. 2, 1949. 12p.

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An experimental study has been made of the orienting effects of silver on sodium chloride crystallized from solution. Strong epitaxy (oriented overgrowth) was observed in the following cases: (1) on oriented films of silver with (100) and also with (111) planes parallel to the surface; (2) on polycrystalline high-purity silver. Growth of crystallites across grain boundaries without effect lends support to the view that the orientation of a small nucleus, or embryo, determines the orientation of the entire crystal. It is suggested that the orienting characteristics of silver on sodium chloride may be used as an indication of relative orientations in polycrystalline material and of testing the degree of orientation in oriented thin films. (auth)

6567 The Specific Ionization Curves for Hydrogen and Deuterium. T. N. Hatfield, A. E. Lockenvitz, and J. M. Young. J. Franklin Inst. 250, 309-13(1950) Oct.

The specific ionization (Bragg) curves are obtained for hydrogen and deuterium, with alpha particles from polonium as the ionizing source. The curves (a relationship between the stopping power of the element for α particles and its atomic number) are found to coincide quite closely and the stopping powers as determined from the curves are the same for both gases. 11 references. (auth)

6568 Physical Constants of Niobium Pentafluoride. E. J. Barber, R. L. Farrar, Jr., J. H. Junkins, and H. A. Bernhardt. K-652, Aug. 24, 1950. 27p.

Niobium pentafluoride was prepared by fluorinating the metal with elemental fluorine at 300°C. By means of warming and cooling curves, the melting point was found to be 78.9 ±0.2°C, and the heat of fusion was estimated to be 8600 cal/mole. A sample of the compound was distilled in a 20-plate liquid-take-off column. The vapor pressure of the middle fraction was investigated and may be expressed by the equation, $\log P_{mm\ Hg} = 8.3716 - 2779.3/T$. Using the value of the heat of fusion given above, the vapor pressure over the solid may be expressed by the equation, $\log P_{mm\ Hg} = 14.397 - 4900/T$. The liquid density was measured in the range 86 to 125°C and may be expressed by the equation $d = 2.8026 - 9.81 \times 10^{-4}t - 6.6 \times 10^{-6}t$ where t is in degrees centigrade. The following thermodynamic quantities for the vaporization process were calculated from the vapor pressure data and corrected for deviation from ideality by the density measurements: $C_p = -8.5$ cal/deg/mole, $H^0_v = 16,800 - 8.5\ T$, $F^0_v = 16,800 + 19.6\ T \log T - 86.1\ T$, $S^0_v = 77.6 - 19.6 \log T$. The boiling point was calculated to be 233.3 ± 0.5°C. The compound was found to be more stable toward hydrolysis than either ruthenium pentafluoride or uranium hexafluoride. There was no evidence of decomposition of niobium pentafluoride at temperatures up to 255°C. (auth)

6569 The Determination of Fluorine in Organic Compounds. J. F. Ellis and W. K. R. Musgrave. J. Chem. Soc., 1969-70(1950) July. (Note)

The determination of fluorine in organic compounds by titrating with thorium nitrate solution in the presence of starch has been examined in some detail with respect to interfering ions and correct procedure.

6570 The Dissociation Energy of Fluorine. M. G. Evans, E. Warhurst, and E. Whittle. J. Chem. Soc., 1524-34 (1950) June.

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The objections raised by some authors to the value of $D(F_2) = 63.5$ kcal/g mole appear to be well founded. Recent work appears to be much more reliable. It is concluded that the experimental data at present available indicate strongly a value for $D(F_2)$ of about 37 kcal/g mole, certainly not greater than about 45 kcal/g mole. The energy terms which enter into the calculation of electron affinities using the Born-Haber cycle have been reexamined. It is considered that a value of $D(F_2) = 37$ kcal/g mole leads inescapably to a value for the electron affinity of gaseous fluorine atoms which is less than that of chlorine. There appear to be no uncertainties in the various energy terms which could be large enough to reverse this conclusion. On the other hand, it has been shown that the electron affinity of fluorine in solution (i.e., the electron affinity of the gaseous atom plus the heat of solution of the negative ion) remains larger than that of chlorine. The effects of changes in the value for $D(F_2)$ on the heats of a number of simple processes of interest and on the ionic character of covalent bonds involving fluorine have been discussed. (auth)

6571 The Fluorination of Organic Compounds Containing Nitrogen. R. N. Haszeldine. J. Chem. Soc., 1966-8(1950) July.

The fluorination of pyridine and aniline by the cobalt fluoride and catalytic methods yields the nonbasic perfluoropiperidine and perfluorocyclohexylamine, respectively. The fluorination of dimethylaniline gives perfluorocyclohexane, perfluorodimethylamine, and possibly perfluorodimethylcyclohexylamine. Methylaniline similarly yields perfluorocyclohexane and perfluoromethylamine; the latter compound, which is nonbasic, is also obtained by the passage of methylamine over cobalt trifluoride. (auth)

6572 A Heterocyclic Perfluoro-compound. R. N. Haszeldine. J. Chem. Soc., 1638(1950) June. (Note)

The complete fluorination of hydrocarbons has been achieved using the catalytic, the cobalt trifluoride, and the electrochemical method, but the fluorination of compounds containing nitrogen has received little attention. The complete fluorination of a heterocyclic nitrogen-containing compound has not yet been reported. The fluorination of 2,6-lutidine has now been investigated. The catalytic and cobalt fluoride methods were used successfully after slight modification to prevent, as far as possible, the formation of the nonvolatile hydrofluoride of the dimethylpyridine. A product believed to be perfluoro-2,6-dimethylpiperidine has been isolated as a solid, mp 94 to 95°C, with a characteristic musty odor, which can be purified by sublimation at 50 to 60°C/760 mm or by recrystallization from carbon tetrachloride. Perfluoro-2,6-dimethylpiperidine crystallizes as large needles and is readily soluble in hot carbon tetrachloride but much less soluble at room temperature; in this respect it resembles perfluorohexadecane, $C_{16}F_{34}$, which, however, crystallizes as plates from carbon tetrachloride.

6573 The Reaction of Fluorine with the Oxides and Oxycompounds of Manganese and Rhenium. E. E. Aynsley, R. D. Peacock, and P. L. Robinson. J. Chem. Soc., 1622-4(1950) June.

Potassium permanganate and the oxides of manganese on reaction with fluorine yield manganese trifluoride contaminated with a little manganese difluoride. No oxyfluoride of manganese is produced in these reactions. Rhenium dioxide

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and potassium perrhenate give two new oxyfluorides, rhenium oxypentafluoride, $ReOF_5$, and rhenium dioxytrifluoride, ReO_2F_3. That the highest fluoride of rhenium is ReF_6 has been confirmed. No evidence has been obtained of the previously reported oxyfluorides $ReOF_4$, ReO_2F_2, ReO_3F, and $ReOF_2$. (auth)

6574 The Reaction of Methyl Radicals with Olefins. Part IV. The Reaction with Tetrafluoroethylene and Vinyl Fluoride. F. A. Raal and C. J. Danby. J. Chem. Soc., 1596-9(1950) June.

The rate of polymerization of tetrafluoroethylene induced by acetaldehyde photolysis is very much greater than that of ethylene under the same conditions. An insoluble solid polymer is produced for which the kinetic results suggest a molecular weight corresponding to about 26 fluoroethylene units. In contrast to the behavior with the lower olefins, the rate of aldehyde photolysis is greatly increased by the presence of fluoroethylene. By analogy with the previous results, a chain polymerization is assumed to be initiated by methyl radicals from the aldehyde photolysis, a fluorinated radical which can initiate further polymerization being eventually produced by chain transfer. The experimental results require that this radical should be able to induce the decomposition of a molecule of acetaldehyde into carbon monoxide and methane without itself suffering any change in the process. Vinyl fluoride is also polymerized by aldehyde photolysis, the rate of which is unchanged. This can be explained if every polymerization chain suffers chain transfer. (auth)

6575 Monthly Report on Graphite Tests. M. D. Burdick. National Bureau of Standards. NEPA-1086, July 22, 1949. 6p.

A brief summary of procedures in testing coated graphite, in air at 1800°F with no load, is presented. Testing of uncoated graphite was stopped due to failure of graphite clamps. Data on expansion tests for two grades of graphite with the per cent expansion from room temperature to 2500°F and the bulk density of various specimens are included.

6576 Monthly Report on Graphite Tests. M. D. Burdick. National Bureau of Standards. NEPA-1161, Sept. 23, 1949. 5p.

Brief comments are made on the status of high-temperature creep and expansion tests of uncoated graphite bodies.

6577 Design and Testing of a Teflon Lined Plug Valve; Period of Work, April 29, 1948 - August 9, 1948. C. D. Watson and G. A. West. Oak Ridge National Laboratory. AECD-2923, June 28, 1950. Decl. Sept. 6, 1950. 12p.

It has been demonstrated that a durable, permanently lubricated, leakproof plug valve can be constructed from stainless steel and lined with "Teflon." The "Teflon" lining greatly excels conventional lubricants. Acidic, caustic, and various solvent solutions have been handled over a period of two years with no apparent effect on self-lubrication properties or durability of such linings. (auth)

6578 Heat Conductivity Gauge for Determining CO_2 in Air at Low Pressures, Modification and Calibration. A. L. Roberts and E. T. Swinburne. Imperial Chemical Industries, Ltd. BR-377A, Feb. 5, 1950. 8p.

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An instrument for determining CO_2 concentrations in CO_2-air mixtures at low pressures is described. Attempts to calibrate the instrument with CO_2-air mixtures met with little success owing to "wandering" of the electrical zero. When the instrument was used in its most sensitive state, very slight variation of the voltage applied to the bridge was sufficient to cause serious errors in calibration. Results of modification to match the resistances of the measuring and reference elements carefully, and at the same time to modify the method of securing the platinum elements to the copper terminals are reported as satisfactory. (auth)

6579 Opening Active Ampoules by Remote Control. J. Franklin Inst. 250,357(1950) Oct. (Note from the National Bureau of Standards)

A new oven loading technique, developed by Jesse Sherwood of the National Bureau of Standards for use in the atomic-beam clock program, overcomes one difficult problem of atomic beam experimentation—the introduction of highly reactive materials, such as alkali metals, into the "oven" which acts as the beam source. In the new technique developed by the Bureau's Microwave Standards Section, the difference in the thermal expansivity of aluminum and glass is utilized. The oven used with the atomic-beam magnetic resonance apparatus is of a conventional type, but the cesium metal—the frequency stabilizing element of the new atomic-beam clock—is distilled into a specially designed ampoule and sealed off under vacuum. The ampoule contains a well into which is inserted a carefully lapped aluminum plug of about 7-mm diameter. This plug is removed before filling and then set firmly in place after sealing. When the ampoule is heated to 80 to 100°C, it will crack because of the larger thermal expansivity of aluminum, with reference to glass.

6580 The Chelation of Praseodymium as a Function of pH Using Thenoyltrifluoroacetone. John F. Suttle and Thomas F. Keenan. Los Alamos Scientific Laboratory. LA-1104, Apr. 27, 1950. 14p.

The distribution ratio of praseodymium between an aqueous phase containing 1 mg of Pr^{+++} per milliliter and enough NH_4Cl to give an ionic strength of 0.1 and a benzene phase 0.2M or 0.5M in thenoyltrifluoroacetone (TTA) has been determined as a function of hydrogen ion concentration over the pH range 2.8 to 4.3. The ratio was measured by using Pr^{142} as a tracer and counting equal aliquots of each phase. The average charge on the aqueous praseodymium species and the exponent of the hydrogen ion concentration in the equilibrium equation were found to be 3 within the experimental error of the measurements. The equilibrium constant is $(3.34 \pm 0.23) \times 10^{-9}$ in 0.2M TTA and $(3.39 \pm 0.37) \times 10^{-9}$ in 0.5M TTA. Comparison with data on lanthanum and cerium indicate that it should be possible to separate these elements from praseodymium by this method.

6581 Mass Assignments of Alpha-Active Isotopes in the Rare Earth Region. J. O. Rasmussen, F. L. Reynolds, S. G. Thompson, and A. Ghiorso. UCRL-863, Aug. 9, 1950. 6p.

The presence of α radioactivity in the rare earth elements has been attributed to the influence of the stable configuration of 82 neutrons on the daughter nuclides. This suggestion has been tested and confirmed by mass assignments of 149

to the terbium isotope of 4.0-hr half-life and of 147 to the natural radioactivity of samarium. The Tb^{149} assignment was made by a mass-spectrographic separation of terbium activity onto a photographic plate, followed by particle detection with a transfer-plate technique. A sample of isotopically pure Sm^{147} was obtained by ion-exchange chemical separation from an 0.8-mg amount of Pm^{147} which had been allowed to decay for about a year. The α activity of Sm^{147}, determined by pulse analysis, is roughly of the order of magnitude to account for the total α activity observed in natural samarium. The possibility that there may be also some α radioactivity of nearly the same energy associated with Sm^{148} has not been ruled out.

6582 The Arc and Spark Spectra of Gadolinium. Henry Norris Russell. J. Optical Soc. Am. 40, 550-75(1950) Sept.

Analyses based on wave-numbers and intensities have led to the classification of 1177 lines of Gd II, and 1217 of Gd I. The percentages of the stronger lines which have been classified are, respectively, 77 and 90; of all lines 45 and 40. Almost all lines of astrophysical interest are included. All the identifiable terms are derived from the ground-state $^8S^0$ of the triply ionized atom. A complete analysis will probably be very difficult. The multiplets are remarkably regular for so high an atomic number. Intercombinations are numerous and strong, and often occur between terms differing widely in multiplicity and type. Terms of multiplicity 11 are present in Gd I and account for some of the strongest lines.

6583 Double Salts Formed by Lanthanum, Cerium, Praseodymium, and Neodymium with Tetra-phenyl-phosphonium Nitrate. G. V. Medoks and N. N. Sakharova. Doklady Akad. Nauk S.S.S.R. 73, 1201-05(1950) Aug. 21. (In Russian)

The idea of using double salts for the separation of rare earths by fractional crystallization belongs to Mendeleev (Ann. 168, 45(1873)). The method was followed by several workers, beginning with Auer von Welsbach (Monatshefte 6, 477) who separated "didymium" into praseodymium and neodymium. The present authors studied the behavior of such double salts involving a tetra-substituted organic base, viz., the tetra-phenyl-phosphonium $(C_6H_5)_4P$. The salts obtained had the general composition $Me(NO_3)_3.2(C_6H_5)_4PNO_3$, with Me = La, Ce, Pr, or Nd (the La salt crystallized with $8H_2O$). They presented well defined melting points and differed in solubility in absolute alcohol (water decomposes them). Similar compounds involving arsonium are being prepared.

6584 The Law of Oxidation of Metallic Cerium and Its Generalization to Other Metals. Jean Loriers. Compt. rend. 231, 522-4(1950) Sept. 4. (In French)

The aggregate oxidation of cubic cerium is the sum of the separate reactions $2Ce + 3O \rightarrow Ce_2O_3$(cubic) and $Ce_2O_3 + O \rightarrow 2CeO_2$. The law of equivalent volumes indicates that the sesquioxide should form a continuous layer on the metal, the oxidation proceeding by diffusion following a parabolic law. In contrast, the less voluminous dioxide should allow the Ce_2O_3 to come into direct contact with the oxygen, the resultant reaction rate being linear. On the basis of these hypotheses, a reaction rate law is derived which gives the

progress of the oxidation of cerium in the dry state at various temperatures. Experimental evidence has confirmed these assumptions. At 20°C, the protective influence of the Ce_2O_3 is preponderant. Between 40 and about 130°C, the presence of the sesquioxide layer becomes progressively less apparent, but even at the ignition point (290 to 320°C) a very thin layer of Ce_2O_3 remains, joined to the CeO_2 by a solid-solution zone. This permits a rapid diffusion of oxygen and constitutes an "oxidation front" with velocity proportional to the temperature. The law which has been derived has been verified only for the oxidation of cerium, but it should be applicable to the oxidation of uranium or other metals, the oxidation of which follows a similar mechanism.

6585 Separation of the Lanthanons with the Aid of Ethylenediamine-NNN'N' -tetra-acetic Acid. J. K. Marsh. J. Chem. Soc., 1819-23(1950) July.

A preliminary survey of the possibility of separating the lanthanons by fractional precipitation of oxalates or other insoluble salts on breaking their complexes with ammonium or alkali salts of ethylenediaminetetraacetic acid shows that valuable results are achieved. By this mode of fractionation, yttrium comes close to dysprosium in the lanthanon series and is separated very rapidly from erbium and the ytterbium earths. A rapid separation of all the heaviest earths, which form the firmest complexes, is also indicated. The method is recommended as being superior to double alkali-sulfate precipitation for an initial separation. (auth)

6586 Application of Ion Exchange. Copper-Amberlite IR-120 in Fixed Beds. W. A. Selke and Harding Bliss. Chem. Eng. Prog. 46, 509-16(1950) Oct.

The mechanism of the process and the fundamental constants governing the exchange in treatment of dilute wastes have been studied. As a result of this work the following conclusions are drawn.

1. Divalent-monovalent exchanges such as copper-hydrogen and copper-sodium on Amberlite IR-120 follow a nonlinear equilibrium in dilute solutions which may be approximated by the extreme q/a = 1.0 (q = exchanging ion, a = total exchange capacity). This is equivalent to assuming no back "pressure" until the resin is saturated.

2. Copper-magnesium exchange follows an approximately linear equilibrium over these concentration ranges.

3. Probably both liquid and solid diffusional resistance are important in this problem, but the early part of the breakthrough curve (which is the most important from the standpoint of design) is governed almost entirely by diffusion in the liquid around the particles.

4. Behavior of a divalent-monovalent exchange in a fixed bed may be interpreted, and it is believed the design of large beds can be accomplished. The value of k_DS (diffusion constant) for copper-hydrogen is about 1.37 l/hr g with normal-size Amberlite IR-120, a downflow rate of 28.1 cm/min, and at room temperature. This k_DS varies as the 0.7 power of velocity, inversely as particle diameter, as the fourth power of absolute temperature, and should be independent of other variables over the ranges studied. In downflow operation of a bed of widely spaced particle size, the average size of the large particles present in appreciable amounts should be used for interpretation and prediction. For deep beds, the largest particles might be present in sufficient quantity to control the breakthrough. In deep beds,

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there is also a possibility that the apparent $k_D S$ would be reduced because of the accumulated effects of the deviation of the system from the mechanism and equilibrium assumed. For copper-sodium the value of $k_D S$ would be reduced because of the accumulated effects of the deviation of the system from the mechanism and equilibrium assumed. For copper-sodium the value of $k_D S$ is about 95% of the above. The value of a is about 4.5 meq/g for this resin.

5. Behavior of a copper-magnesium exchange in a fixed bed may be interpreted, and the design of large beds can be accomplished, it is believed, by the use of Schumann curves with designated parameters. For copper-magnesium the value of $k_D S$ is about 35% of that for copper-hydrogen. The appreciable reduction in $k_D S$ for this divalent-ion system is another disadvantage to this ionic system compared to copper-hydrogen, less favorable equilibrium being the prime one.

6. Copper-calcium exchange does not seem to follow closely the theory of liquid diffusion with linear equilibrium. It is possible that solid diffusion and nonlinear equilibrium both contribute to this effect.

7. The behavior of a bed containing initially some of the ion to be exchanged can be predicted by correcting a for the amount there present and by recognizing that $k_D S$ will be reduced a little by this change with a nonlinear system.

8. For resins with a wide distribution of particle size, upflow operation is to be preferred to downflow from the standpoint of the per cent of utilization of the capacity of the exchanger in a cycle. 17 references. (auth)

6587 Ion Exchange Resins in Chromatography. C. W. Davies. Research 3, 447-52(1950) Oct.

Methods of improving the ion exchange separation of isotopes, rare earths, or other closely similar substances are suggested in this general discussion of the properties of ion exchange resins and the procedures of chromatography. 17 references.

6588 Isotope Shifts in Thorium – Th^{230} and Th^{232}. G. L. Stukenbroeker and J. R. McNally, Jr. AECD-2939, May 22, 1950. Decl. Sept. 18, 1950. 6p.

The discovery of isotope displacements in the spectra of Th^{230} and Th^{232} is noted. Spectrum shifts have been observed, with a 21-ft spectrograph, for more than 200 Th lines and, of several investigated, prominent shifts occur only for low-lying electron configurations involving the penetrating 7s electrons and in ThII are largest for the fs^2 and ds^2 configurations. As in the case of the uranium configurations involving s-type configuration transitions, the shift is observed as a blue shift for the lighter isotope and is, in magnitude, approximately half that observed between the 234 and the 238 isotopes of singly ionized uranium. (auth)

6589 Polarization of the Singlet-Singlet and the Triplet-Singlet Luminescence of Chelate Compounds. S. I. Weissman. J. Chem. Phys. 18, 1258-62(1950) Sept.

The polarizations of the luminescence of the dibenzoylmethane complexes of lithium, potassium, aluminum, lanthanum, and gadolinium have been determined. The first excited singlet state of the univalent chelates has symmetry B_1. The triplet states have not been uniquely classified. The nature of the perturbation of the triplet state introduced by the magnetic gadolinium ion seems qualitatively different from the perturbations introduced by nonmagnetic ions. (auth)

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6590 Alkali Metal Carbonyls. I. Preparation of Meso-Inositol-C^{14} from Potassium Carbonyl-C^{14}. R. Christian Anderson. Brookhaven National Laboratory. AECU-956, nd. 1p.

This document is reproduced in its entirety.

Several of the alkali metal carbonyls are being studied as to their structure and use in organic synthesis. The following reaction sequence has been investigated: $K + CO \rightarrow (KCO)_x$; $(KCO)_x + CH_3OH \rightarrow CH_3OK$ + dipotassium tetrahydroxybenzoquinone; the quinone + H_2 (Raney Ni) → isomeric cyclitols (meso-inositol, etc.). The possibility of obtaining a benzene derivative from potassium carbonyl was first mentioned by Nietzki and Benckiser (Ber. 18, 1834 (1885)). The reduction of tetrahydroxybenzoquinone to a cyclitol mixture was reported by Anderson and Wallis (J. Am. Chem. Soc. 70, 2931 (1948)). It is thus possible to label meso-inositol with C^{14} by starting with readily available $C^{14}O$. Details of the synthesis and some possible structures for the potassium carbonyl will be discussed.

6591 Organic Phosphorus Insecticides. Part I. Synthesis of Bisdimethylaminophosphonous Anhydride Containing ^{32}P. J. E. Gardiner and B. A. Kilby. J. Chem. Soc., 1769-72(1950) July.

A method is described for the conversion of radioactive phosphoric acid into phosphoryl chloride on a small scale, and thence through chlorobisdimethylaminophosphine oxide into bisdimethylaminophosphonous anhydride. The labeled product is suitable for tracer work in plants (in which the compound acts as a systemic insecticide) and in animals (where it shows anticholinesterase activity). Preparation of the nonradioactive form on a larger scale is also described. (auth)

6592 Preparation of $GaCl_3$ and $GaBr_3$ from the Metal and Metal Halides. F. Hitzig. Angew. Chem. 62, 366 (1950) Aug. 7. (In German)

This report is reproduced here in its entirety.

Gallium is known to have two isotopes, Ga^{69} and Ga^{71}. Since two isotopes of chlorine also occur, the possible combinations give eight different kinds of molecules for gallium(III) chloride. The number can be reduced to two if only Cl^{35} is present. A convenient method of preparation of $GaCl_3^{35}$, and also of $GaBr_3$, is, therefore, desirable for isotope separation. The preparation from Cl_2^{35} and gallium metal is not feasible because of the poor yield with respect to the expensive Cl_2^{35} and other considerations. Silver chloride reacts with gallium according to the equation $3AgCl^{35} + Ga \rightarrow 3Ag + GaCl_3^{35}$ to produce gallium(III) chloride with an 80 to 85% yield. The reaction also goes with $PbCl_2$, CuCl, and many other metal chlorides and gives $GaCl_3$ of great purity. The corresponding bromides may be used to prepare gallium(III) bromide. Au, Pt, and W are resistant to $GaCl_3$, but Ag and Cu dissolve in $GaCl_3$ as readily as does salt in water. From these solutions $GaCl_3$ may be sublimed away. From the solutions in $GaCl_3$ of Pb, Cd, Zn, or Hg, a mixture of the metal and $GaCl_3$ sublimes, rather than the pure $GaCl_3$ alone. Gallium(II) chloride does not sublime in the pure state; the sublimate has a gray color as a consequence of disproportionation of the $GaCl_2$ into $GaCl_3$ and Ga.

6593 The Thermal Decomposition of Nitrous Oxide. L. Friedman and J. Bigeleisen. Brookhaven National Laboratory. AECU-969. nd. 1p.

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This report is reproduced in its entirety.

Several mechanisms have been proposed for the thermal decomposition of nitrous oxide. The experimentally observed variation of half-time with initial pressure has been accounted for by both a quasi-unimolecular process (C. N. Hinshelwood, "The Kinetics of Chemical Change," New York, Oxford Press, 1945, (p. 134-6) and an atomic chain mechanism of 1.5 order (R. N. Pease, "Equilibrium and Kinetics of Gas Reactions," Princeton University Press, 1942, p.128-34). The thermal decomposition of $N^{15}N^{14}O$ has been investigated with the expectation of obtaining additional information on the mechanism of this reaction. Samples containing approximately 7.5% and 60% $N^{15}N^{14}O$ were thermally decomposed and the reaction products were analyzed mass spectrometrically. The decomposition produces essentially nonequilibrated $N^{15}N^{14}$ from $N^{15}N^{14}O$. Traces of $N^{15}O$ were observed in the decomposition of a sample containing approximately 60% $N^{15}N^{14}O$. The results clearly indicate that the N-N bond in N_2O is not ruptured in the decomposition process. It follows that any mechanism proposed for this reaction involving rupture of the N-N bond must be rejected. The mechanism of the thermal decomposition and the catalytic role of nitric oxide will be discussed in the light of these results.

6594 A Note on the Mechanism of the Formation of Alpha-Acylamino Ketones from Amino Acids. Arthur Fry and Henry Rapoport. UCRL-877, Aug. 23, 1950. 9p.

The reaction of alanine-1-C^{14} and phenylalanine-1-C^{14} with acetic anhydride in the presence of pyridine has been studied, and the carboxyl group of the amino acid has been shown to be the exclusive source of the carbon dioxide involved. (auth)

6595 More Uses for Radioactive Tracers. Iron Age 166, 73(1950) Sept. 28.

In the investigation of current and metal distribution in electrodeposition, a known fraction of Cu^{64} is introduced into a copper sulfate solution from which copper is deposited upon a cathode at a known average current density. The cathode is then radioautographed, or it is then cut into strips and the amount of codeposited radioactive copper determined by means of a Geiger counter. The distribution of radioactive (and, therefore, also of stable) copper on the cathode can thus be established within very close limits. Satisfactory distribution determination can be made of extremely thin deposits. The method is especially suitable for ascertaining primary current distribution on an electrode. No further details are included.

6596 On the Problem of the Mechanism of Ion Exchange between a Solution and a Precipitate. A. N. Murin. Doklady Akad. Nauk S.S.S.R. 74, 65-8(1950) Sept. 1. (In Russian)

Several problems relative to ion exchanges between $AgNO_3$ solutions and powders of AgCl and AgBr were investigated with the aid of radioactive Br and the long-lived radioactive isotope of Ag.

6597 The First Isolation of Americium in the Form of Pure Compounds; the Specific Alpha-activity and Half-life of Am^{241}. B. B. Cunningham and L. B. Asprey. University of California Radiation Laboratory. AECD-2946, July 20, 1950. Decl. Sept. 26, 1950. 28p.

The microgram scale isolation and preparation of pure compounds of americium are described. Data are presented to show that the alpha-half-life of the isotope Am^{241} is 490 ± 14 years. The absorption spectrum of Am(III) in 1M nitric acid in the range 3500 to 8000 mμ is given. The wavelengths of 10 of the most prominent lines in the copper spark emission spectrum of americium are given to the nearest 0.01 A. Evidence is presented to show that the potential for the Am(III)-Am(IV) couple in acid solution is more negative than −2 v and that the potential for the Am(II)-Am(III) couple is more positive than ±0.9 v. (auth)

6598 The Formal Potential of the Am(V)-Am(VI) Couple. R. A. Penneman and L. B. Asprey. Los Alamos Scientific Laboratory. AECU-936, Sept. 9, 1950. 5p.

The formal potential of the Am(V)-Am(VI) couple has been determined by direct measurement in a 0.3M $HClO_4$ solution prepared from pure Am(VI) after partial reduction to Am(V), by direct measurement in a 1M $HClO_4$ solution containing Am(VI) and Am(V) derived from the disproportionation of pure Am(V), and by indirect calculation from the partial oxidation of Am(V) to Am(VI) with ceric perchlorate. The value of the Am(V)-Am(VI) couple is taken as −1.600 ± 0.005 v in 1M $HClO_4$. Similar measurements on U, Np, and Pu show that the (V)-(VI) couple is independent of H^+-ion concentration in the range 0.1M to 1M. The complexing effect of sulfate on americyl ion is about the same as for neptunyl ion.

6599 The Magnetic Susceptibilities of Some Compounds of Americium and Curium. W. W. T. Crane, J. C. Wallmann, and B. B. Cunningham. UCRL-846, Aug. 1, 1950. 19p.

The molar magnetic susceptibility of CmF_3 has been found to be $-(22{,}500 \pm 4000) \times 10^{-6}$ cgs units in an environment at 295°K and $-(58{,}000 \pm 6000) \times 10^{-6}$ in an environment at 77°K. The temperatures of the samples were probably significantly higher because of the self-heating caused by radioactivity of the isotope Cm^{242}. The susceptibility of CmF_3 is in agreement within experimental error with that expected theoretically for a $5f^7$ configuration. The susceptibility of AmF_3, corrected for diamagnetic contributions, was found to be $(1040 \pm 300) \times 10^{-6}$, $(1290 \pm 300) \times 10^{-6}$, and $(1740 \pm 300) \times 10^{-6}$ at temperatures of 295, 199, and 77°K, respectively. The susceptibility of AmF_3 and its temperature dependence are in agreement with a $5f^6$ configuration for Am^{+3} and a multiplet splitting between the $^7F_0$ and $^7F_1$ states comparable to kT, but smaller than in the case of europium(III). (auth)

6600 Spectra of Uranium and Rare Earth Salts in Solutions Fluid at 77°K. Simon Freed and K. M. Sancier. Brookhaven National Laboratory. AECU-958, nd. 1p.

The document is reproduced here essentially in its entirety.

The absorption spectra of solutions at 77°K of anhydrous salts of uranium and hydrated salts of gadolinium, samarium, and neodymium were taken in the visible and ultraviolet regions of the spectrum. The solvent consisted mainly of propane and propene and a few per cent of n-propyl alcohol. The spectrum of the anhydrous tetrachloride of uranium in solution had the characteristics of rare earth spectra, lines gathered into groups; but the line widths were greater in general than those from rare earths. On the other hand, the spectrum of the solution of hexahydrated bromide of gadolinium was sharper than most rare earths show from

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the crystalline state at the low temperature — about 1 to 2 A wide. The spectrum of the solution of uranium tetrachloride possesses a continuum, rather sharply limited at about 3000 A. When continuous ultraviolet radiation extending beyond this limit is absorbed by the solution at 77°K, a photochemical transformation occurs yielding a bright red solution.

6601 The Uranyl Nitrate–Water System above 60°C. W. L. Marshall, Jr., J. S. Gill, and C. H. Secoy. Oak Ridge National Laboratory. ORNL-797, Sept. 18, 1950. 10p.

Revised solubility data are presented for the system uranyl nitrate – water from 60 to 184°C. The uranyl nitrate trihydrate is shown to have an incongruent melting point at 113°C and the dihydrate to have a stable melting point at 184°C in contradiction to information presented in the literature. Special precautions were taken to insure the correct stoichiometric ratio between UO_3 and HNO_3 in the salt, an excess of either free acid or oxide having a marked effect on the solubility.

6602 Chemical State of Atoms Formed from U^{239} during the (n,γ) Reaction and during the Natural α Disintegration. J. Govaerts and P. Jordan. Experientia 6, 329-30(1950) Sept. 15. (Note; in French)

A pyridine solution of uranyl-salicylaldehyde-o-phenylenediimine was irradiated with neutrons, and the behavior of radioactive atoms formed by Szilard effect was observed in an electric field. It was found that UX_1 atoms, produced by the natural α decay of U, are charged and are deposited on the cathode, while U^{239} atoms, formed by neutron capture, are neutral and remain in the solution as an oxide. (auth)

6603 Concentration and Extraction of Uranium from Several Types of Canadian Ores. Department of Mines and Technical Surveys. NP-1599, Mar. 3, 1950. 26p.

An interim report on test work carried out at the Mines Branch on the economical extraction of uranium from ores, including low grade ores, is presented. Gravity concentration, leaching, sink and float, floatation, and pre-concentration methods are considered. Examples of ores treated and a flow sheet for a concentration procedure are included.

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6604 Study of Effects of Turbulence Promoters on Heat Transfer. Covering Month of March 1950 (Report No. 4). A. Shaffer and O. E. Teichmann. Armour Research Foundation. NEPA-1399, Apr. 18, 1950. 10p.

A literature survey on the forced convection heat transfer–friction relation is reported (35 references). Theoretical studies of the heat transfer process during flow in roughened tubes are reported and the heat transfer–momentum transfer analogy is considered for the present case.

6605 Study of Effects of Turbulence Promoters on Heat Transfer. Covering Month of April 1950 (Report No. 5). A. Shaffer and O. E. Teichmann. Armour Research Foundation. NEPA-1431, May 16, 1950. 4p.

Completion of a literature survey and progress of theoretical studies on flow in roughened tubes are reported.

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Flow in smooth tubes, in tubes with sharp edges or irregular roughness, and in tubes with wavy roughnesses is considered.

6606 Diffusion and Flow of Gases and Vapours through Micropores. II. Surface Flow. P. C. Carman and P. Le R. Malherbe. Proc. Roy. Soc. (London) 203A, 165-78(1950) Sept. 22.

Flow through porous plugs has been measured under conditions where surface flow of absorbed gases makes an important contribution. An analysis of variables affecting surface flow enables surface diffusion coefficients to be calculated and has indicated conditions likely to reduce the correction for flow in the gaseous phase to small proportions. This has been confirmed by studying the effect of variations of porosity. Surface diffusion coefficients tend to increase with "coverage" of the absorbent surface. Activation energies measured for one system were found to be rather small. Owing to the variation of surface diffusion coefficients with coverage, it proved difficult to obtain accurate values. Activation energies indicated a tendency to decrease as coverage increases.

6607 Graphical Determination of Wall Temperatures for Heat Transfers through Walls of Arbitrary Shape. Otto Lutz. National Advisory Committee for Aeronautics. NACA-TM-1280, Apr. 1950. 16p. Technical Memorandum.

A graphical method is given, which permits determination of the temperature distribution during heat transfer through arbitrarily shaped two-dimensional wall. Three examples are presented to illustrate the method. (auth)

6608 Liquid Metal Heat Transfer Fluid. Problem No. 526. Final Report. American Smelting and Refining Co. July 10, 1950. 17p. (AEC File No. NP-1637)

Results obtained during an investigation of low-melting alloys containing bismuth, indium, lead, tin, and thallium are summarized. Properties studied include freezing points, density, and expansion. The corrosion of structural materials by several of these liquid alloys was investigated also. A bibliography, which supplements one issued previously, is included. The discovery of seven new alloys freezing below 210°F, which do not expand on freezing and cooling to room temperature is reported. These alloys should meet specified vapor pressure requirements and should not separate grossly on freezing. A number of constructional materials have been found which have possibilities as container materials for several of these alloys. 44 references. (auth)

6609 The Low Temperature Heat Capacity of Sodium Hydroxide; the Entropy of Sodium Hydroxide at 298.16°K. Paul E. Snyder and John C. R. Kelley. Carnegie Institute of Technology. June 1950. 23p. (AEC File No. NP-1627)

A survey of the available literature reveals the absence of any data presenting the heat capacity of NaOH(c) in the range 0°K to 300°K. Since the most precise information concerning the entropy of crystalline solids is based upon the third law of thermodynamics (Lewis and Randall, "Thermodynamics and the Free Energy of Chemical Substances," McGraw-Hill, 1923, p. 435-440.)

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$$S_T^\circ = \int_0^T \frac{C_p}{T}\, dT$$

the study reported was organized to provide the necessary heat capacity data for NaOH(c) from the lowest temperatures obtainable in the laboratory to room temperature. Following procedures of purification and analysis of the NaOH and calibration of the calorimeter, the apparatus was disassembled and the calorimeter removed and filled with 29.3602 g of the prepared NaOH(c). The calorimeter was reassembled and the calibration runs were duplicated in procedure. Results of the heat capacity runs and subsequent calculations are tabulated and the resulting curve is illustrated. The smoothed data are presented in a table. The final statement of the entropy at 298.16°K is given as $S_{298.16} = 15.32 \pm 0.1$ eu. 16 references.

6610 Electronic Equipment for the Vacuum Gauges of the Louvain Van de Graaff Machine. G. C. Tavernier and Y. Hecq. Ann. soc. sci. Bruxelles. Ser. I. 120-30(1950) June 22. (In French)

The vacuum gauges of the Van de Graaff accelerator must be capable of indicating pressures between 10^{-6} and 10^{-4} mm Hg in the acceleration column and pressures generally below 10^{-3} mm Hg in the fore-vacuum system of the oil-diffusion pumps. Circuit diagrams and auxiliary equipment are given for the thermocouples used in the fore vacuum and for the ionization gauges and Phillips gauges used in the main vacuum line.

MINERALOGY, METALLURGY, AND CERAMICS

6611 Fundamental Properties of Metal-Ceramic Mixtures at High Temperatures. Periodic Status Report No. 21. June 1 to July 31, 1950. W. B. Crandall and W. G. Lawrence. July 31, 1950. 11p. (AEC File No. NP-1705)

Data on firing time and atmosphere for materials which include ZrN, TiN, Mg_3N_2, SiN, BN, Al-B, Mo-Al, Si-Cr, Ni-Mo, Ni-Cr, etc., have been tabulated. (76 items).

6612 Note on the Preparation of Glazes Containing Strontium Compounds. R. W. Thackray and A. E. Williams. Atomic Energy Research Establishment. AERE-M/TN-4, nd. 2p.

The use of isotopes of high specific activity as radioactive sources for industrial applications depends on the development of methods for safe handling. One possible technique is the use of radioactive ceramic glazes on a base material. Experiments which have been carried out on the preparation of glazes from strontium compounds are described. The composition corresponding to a mixture of 10% SrO and 90% commercial sodium silicate ($Na_2O.2SiO_2$) was found to be most satisfactory as it combined appreciable SrO content with reasonably low melting and glazing temperatures.

6613 A Status Report on Hot-Pressed Synthetic Fluorine-Mica, a New Ceramic Dielectric. R. A. Hatch, Wilhelm Eitel, and R. A. Humphrey. Electrotechnical Laboratory, Norris, Tenn. Apr. 1950. 10p. (AEC File No. NP-1533)

Sintered or hot-pressed, synthetic fluorine-mica is a new type of polygranular-mica ceramic material that does not require a glass binder. It can be made from relatively inexpensive chemical raw materials by solid-state reaction with or without the application of pressure at moderate temperature. The ceramic material should prove to be a highly useful dielectric insulator, possessing the advantages of Mycalex and block talc, and, in addition, having excellent weathering resistance and good machinability. The properties of the material can be controlled over rather wide ranges because of the very large number of different fluorine-mica compounds that it is possible to synthesize. The properties may be varied still further by the introduction of other compounds such as metals, oxides, silicates, fluorides, carbides, and graphite. (auth)

6614 Room and Elevated Temperature Properties of Powder Extruded Magnesium Alloys Containing Aluminum, Beryllium, and Zirconium. Quarterly Status Report, May 1, 1950 - August 1, 1950. Dow Chemical Co. COO-16, nd. 15p.

The low neutron-capture cross section of magnesium makes this metal a highly desirable material for atomic energy applications. The elements with which magnesium may be alloyed for strengthening purposes at elevated temperatures are limited in number by the necessity for low neutron-capture cross section, reasonable solubility in magnesium, and existence of an alloying technique. Magnesium alloys containing aluminum and zirconium have been produced by extrusion of powder mixtures and preliminary results of creep tests are reported. Since the addition of calcium increases the creep resistance of Mg-Zr alloys, the investigation of Mg-Al-Ca-Zr alloys containing no more than 1% Ca is recommended. Addition of beryllium may produce a grain-coarsening effect tending to increase the creep resistance at elevated temperatures. Alloys containing cerium and thorium are markedly superior to Mg-Al-Zr alloys at equivalent levels of neutron-capture cross section.

6615 The Entropies of Melting of Metals. R. A. Oriani. SO-2002, Aug. 1950. 18p.

The melting process can be conceived as consisting of first an expansion and then a disordering of the crystalline structure. The entropy contribution from the first effect is calculated by analogy with the process occurring in a volume expansion within an individual phase; the entropy contribution from the melting disorder is then obtained by difference from the measured entropy of fusion. Tentative conclusions of heuristic value are drawn from the relative magnitudes of the various quantities. A simple model for the melting process is adopted, making possible a correlation between the amount of disordering during melting and the structural contribution to the entropy of melting. (auth)

6616 The Application of Radioactive Tracers to the Study of Metal-Solution Reactions. M. T. Simnad. J. Metals (N. Y.) 188, 1220(1950) Oct.

The article is reproduced here in its entirety.

As part of a general project to study the properties of metal surfaces, experiments are being carried out designed to elucidate the influence of surface treatment and structure upon the reactions taking place when metals are placed in ionic solutions containing radioactive ions. The behavior of metals in solutions may be studied in greater detail with the aid of radioactive tracers than has been possible with the

methods previously available. This applies especially to cases where some of the ions in solution are composed of the same element as the metal, and the tracer technique is then the only method that can be used to follow the reaction.

The first part of the work deals with the so-called phenomenon of "exchange" between metals and radioactive ions in solution. This was first demonstrated in 1929 by Hevesy who found that when a specimen of lead was placed in a solution containing thorium B ions it acquired a surface activity corresponding to more than 1000 atoms thick of thorium B. No further work appears to have been done on the subject until recent years when Rollin, Coffin and Tingley, Hensley, et al. published notes on some experiments confirming this phenomenon with radioactive silver and sodium ions. In our studies, radioactive ions of cobalt, chromium, nickel, and iron are being used in solutions into which are immersed numerous metals and alloys with various surface treatments. The effect of the presence and absence of oxygen in the solutions and of oxide films on the metals, the influence of time, temperature, and pH are being studied. The distribution of the radioactive ions deposited on the metal surfaces is shown by means of autoradiographs and their quantity measured by counting with a Geiger-Mueller counter.

The experiments with radioactive cobalt and chromium indicate that the phenomenon of exchange is actually a local electrolysis resulting from differences in electrode potential on the metal surfaces. The experiments with radioactive chromium, in which active chromate ions were used in the solutions, have served to show that passivity in chromate solutions results from the deposition of chromate ions at anodic points on the metal surface, and the distribution of these points following various passivating treatments is brought out in autoradiographs of the specimens. Further experiments have been designed or are in progress using radioactive chromium to study the nature and composition of oxide films on stainless steels and their behavior in solutions, and to throw further light on the phenomenon of grain-boundary sensitization of stainless steels.

In conjunction with these experiments, work is in progress to study the kinetics and mechansim of electrodeposition in very dilute solutions and in its earliest stages. The influence of the numerous factors which affect the nature of electrodeposits will be studied, especially the influence of surface structure upon the nucleation and growth of the deposits. The use of tracers is a highly sensitive tool for the study of this subject. (auth)

6617 The Isothermal Transformation of a Eutectoid Beryllium Bronze. Ronald H. Fillnow and David J. Mack. J. Metals (N. Y.) 188, 1229-36(1950) Oct.

Above the nose of the T-T-T (transformation temperature versus time) curve the first product is fine lamellar pearlite, which subsequently transforms to a coarse pearlite by nucleation and growth. At lower temperatures this coarse pearlite also forms directly from the beta phase. Numerous metastable structures are formed before the pearlite reactions begin. The transformation is followed by metallographic microhardness and x-ray methods. (auth)

6618 Less Common Metals. D. B. Broughton. Ind. Eng. Chem. 42, 2023-5(1950) Oct.

A brief review of availability, properties, and comparative costs of titanium, zirconium, tantalum, and the noble metals is presented. 48 references.

6619 The Oxidation of Zirconium at High Temperatures. Daniel Cubicciotti. J. Am. Chem. Soc. 72, 4138-41 (1950) Sept.

The rate of consumption of oxygen by ductile zirconium metal has been studied in the range 600 to 920°. The oxidation curves were parabolic at all temperatures except 920°, where a small deviation toward linear was observed. The oxidation rates were not affected by changing the oxygen pressure from 0.1 to 20 cm. The temperature coefficient of the parabolic rate constant gave an activation energy of 32 kcal/mole. 15 references. (auth)

6620 Pure Vanadium Now in Limited Production. Iron Age 166, No. 14, 95-6(1950) Oct.

Ductile vanadium, 99.8% pure, is now commercially available. Chips for remelting, ingots, and rolled forms are in production. The metal can be rolled at ordinary temperatures and cold reductions up to 85% without annealing have been made. Vanadium machines well and is easily welded with conventional shielded arc methods. (auth)

6621 They're Putting the Saddle on Titanium. Steel Horizons 12, No. 4, 3-5, 26(1950) Fall.

The development of titanium is described, beginning with its early history and continuing through uses of the oxides in paints and coloring mediums to modern development of the Kroll process for separation of the pure metal. Operations by various manufacturers are reported and the formation of titania gems is mentioned. Potential uses of titanium, provided the cost can be lowered, are indicated in many fields.

6622 Zirconium Offers Interesting Properties and Possibilities. Materials and Methods 32, No. 4, 63-4 (1950) Oct.

Zirconium offers high strength and excellent corrosion resistance as its most promising characteristics. Due to an affinity for oxygen and nitrogen and other gases, zirconium must be reduced in a vacuum. Much of the zirconium produced today in this country is made by the iodide process, which results in the production of crystal bars of varying sizes. The crystal bars are then rolled directly into sheet and bar stock. Potential uses are discussed. Physical, mechanical, and corrosion resistance properties are listed.

6623 Diamond Drilling for Uranium. Eng. Mining J. 151, 86-8(1950) Oct.

With diamond drilling going on at the rate of 300,000 to 400,000 ft per year in the Colorado Plateau area, much has been learned about the best techniques suited to that area. The article describes the nature of the formations drilled, the circumstances under which drilling is being done, and drilling methods employed by contractors in the area. At present eight contractors operating about 50 drills are active on the Plateau. Prospect drilling is now going on in Mesa, Montrose, and San Miguel counties in Colorado, and San Juan and Grand counties in Utah. A map is attached. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

6624 Monoclinic Thorium Silicate. A. Pabst. Nature 166, 157(1950) July 22.

The article is reproduced here in its entirety.

The name "huttonite" is proposed for a newly recognized monoclinic mineral of the composition $ThSiO_4$. It has been isolated in minute grains from beach sand of South Westland, New Zealand, by Prof. C. Osborne Hutton, of Stanford University. Its optical properties are: $\alpha = 1.898$, $\beta = 1.900$, $\gamma = 1.922$; dispersion $\rho < \gamma$, moderate; $2V = 25$ deg (measured); Y ∥ b, Z near c; colorless to very pale cream. X-ray study by means of powder, rotation and Weissenberg patterns shows that huttonite is isostructural with monazite. Space group $C2_h^5 - P2_1/n$; $a_0 = 6.80$ A, $b_0 = 6.96$ A, $c_0 = 5.54$ A, $\beta = 104$ deg 55 min. The measured density is 7.1 ± 0.1. The calculated density, corresponding to a cell content of $4(ThSiO_4)$, is 7.18. A full description has been submitted to The American Mineralogist.

6625 Radioactive Tracers in Metallurgical Research. W. S. Eastwood, W. G. Marley, H. M. Finniston, and A. E. Williams. London, H. M. Stationery Office, 1950. 55p.

Chapter 1 describes the nature and methods of production of isotopes and the nuclear processes by which they decay to a lower energy state. The decay of radioactive isotopes is the characteristic which renders them useful as a scientific tool. Chapter 2 presents methods for detection and counting of the nuclear changes. Chapter 3 indicates some experimental work on metallurgical problems which have been attacked with radioactive tracers, and in the final section some possible fields in metallurgy in which tracers might find research application are suggested. Radioactivity is shown to be a hazard to the research worker unless precautions in the handling of isotopes are taken. Chapter 4 describes the hazards and precautions to be observed in the use of tracers. The health aspect is an important one for radioactive work and should be a primary concern of everybody working with active isotopes. The warning is not given as a deterrent to scientists planning tracer work. (auth)

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6626 Technical Physics Handbook; Technological Division. Marvin H. Wilkering, compiler. University of Chicago Metallurgical Laboratory. AECD-2929, Apr. 1943. Decl. Sept. 14, 1950. 25p.

Compilations in tabular or graphic form for convenient use have been made of the following: physical constants and conversion factors; equivalence of energy units; absorption of electrons, protons, and alpha particles; definitions and formulas of radioactivity; gamma radiation.

6627 Some Theoretical Problems Concerning Paramagnetic Substances at Low Temperature. J. M. Jauch. ORNL-813, Sept. 15, 1950. 38p.

The following aspects of the behavior of paramagnetic substances are discussed in such a way that the general principles are illustrated: the Kramers degeneracy (Proc. Acad. Sci. Amsterdam 33, 962(1930)); the quenching of orbital motion in paramagnetic salts; the Curie constants of $CuSO_4 \cdot 5H_2O$; superexchange in $CuSO_4 \cdot 5H_2O$; (ordinary exchange interaction, the magnetic dipole interaction, nuclear interactions, and the effect of superexchange); the specific heat of $CuSO_4 \cdot 5H_2O$; and nuclear interactions of paramagnetic ions (the magnetic dipole interaction and the quadrupole interaction). 36 references.

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6628 Isotopes—Blessing or Curse to Mankind? Eugen Müller. Chem. Ztg. 74, 366-8(1950) July. (In German)

An illustrated, popular account of the separation of natural isotopes, such as U^{235}, and of the production of radioisotopes in atomic piles is presented. The use of isotopes in research is briefly discussed.

6629 On the Cherenkov Effect and the Complex Doppler Effect. A. I. Akhiezer, G. L. Lyubarskiĭ and Ya. B. Faĭnberg. Doklady Akad. Nauk S.S.S.R. 73, 55-8 (1950) July 1. (In Russian)

Wave guides with specially devised metal partitions can be constructed in which, even in the absence of dielectrics, the wave phase velocity is smaller than c. A charged particle, moving along such a system with a constant velocity that exceeds the above phase velocity, generates electromagnetic waves, similar to those produced by a Cherenkov electron in a dielectric. The simple case is examined of linear periodic structures forming a succession of cells traversed by a particle through holes in the partitions. A general formula for the intensity of the radiation is first derived, then a special one for the case of a cylindrical wave guide, by using equations of the complex Doppler effect (Frank, Izvest. Akad. Nauk S.S.S.R. 6, 2(1942)) obtained from the radiation (resonance) condition.

6630 Transit-time Phenomena in Electron Streams. D. K. C. MacDonald. Phil. Mag. 41, 863-72(1950) Sept.

A density modulated electron stream will suffer amplitude reduction and phase variation with transit time due to the statistical velocity distribution of the electrons. The problem is considered in relation to that of noise generation in a beam due to velocity fluctuation; the analysis developed is then used in examining the variation of the space-charge reduction factor (F^{-2}) under particular laws of potential distribution which present themselves in physical problems. (auth)

6631 Analysis of Some Empirical Evidence on Meson Production in Fast Nuclear Collisions. Kurt Sitte. NYO-705, nd. 28p.

A discussion of results on local penetrating showers, of the momentum spectrum of sea-level mesons, and of the geomagnetic effects of the hard component, all prove the following general characteristics of meson production in nuclear collisions: (1) in the energy region accessible to this analysis, the production of low-energy mesons is for all primary energies much more likely than that of more energetic particles; (2) the multiplicity of meson production increases markedly with increasing primary energy; (3) production of "hard component" mesons becomes significant only for primary energies well exceeding 5 Bev; and (4) for all primary energies, the energy distribution of the mesons produced remains roughly the same, while only the number of meson secondaries varies with the primary energy. The "production spectrum" of mesons was re-evaluated. Its maximum appears to lie at somewhat lower momentum values than those given in earlier work.

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6632 The γ-ray Spectrum Resulting from Capture of Negactive π Mesons in Hydrogen. Wolfgang K. H. Panofsky, Lee Aamodt, James Hadley, and Robert Phillips. University of California Radiation Laboratory. UCRL-814, July 1950. 5p.

The material in this document appeared as a letter to the editor in Phys. Rev. 80, 94(1950) Oct. 1, and was abstracted in Nuclear Science Abstracts as abstract 4-6385.

6633 Cosmic Radiation at Great Depths. C. M. Garelli and G. Wataghin. Nuovo cimento 7, 695-6(1950) July 25. (Letter to the editor; in Italian) (See also NSA 4-5923)

The absorption of both π and μ mesons as a function of the underground depth was calculated, the energy loss due to collisions of π mesons with nuclei being taken into consideration. Of the two cosmic-ray absorption curves calculated in assuming, respectively, a strong and a weak absorption of π mesons, that corresponding to the latter hypothesis agreed with experimental findings of Wilson (Phys. Rev. 53, 337(1948)) and of Nishina et al.(Phys. Rev. 59, 401(1941)). It is concluded that the cross section of very energetic π mesons for the phenomenon considered (and also for all other processes involving π-meson absorption) decreases rapidly with growing energy.

6634 Distribution of Nuclear Fissions Close to Large Showers of Heavy Particles. V. Leshkovtsev. Uspekhi Fiz. Nauk 38, No. 3, 1949. 2p. (Translation) (AEC File No. NP-2179)

An analysis of data, which had been reported previously elsewhere, is made which shows that in the fission of nuclei by cosmic particles there occurs not only a flight of different particles making up the nuclei, but also the formation of new particles of the varitron type.

6635 An Experiment on the Anomalous Scattering of Fast μ Mesons by Nucleons. E. Amaldi and G. Fidecaro. Nuovo cimento 7, 535-52(1950) July 25.

Large-angle scattering of fast μ mesons by an iron plate 6 cm thick was investigated by means of a counter hodoscope recording two energy bands, viz., 200 to 320 Mev and >320 Mev. About 500,000 impinging mesons were counted. The following approximate values of upper limits of the cross section for anomalous scattering were obtained: 4.5×10^{-29} cm²/nucleon in the low-energy band, and 2.3×10^{-30} cm²/nucleon in the high-energy band. (auth)

6636 An Instrument for the Study of the Generation of Mesons in the Stratosphere. Nuovo cimento 7, 677-89(1950) July 25. (In Italian)

The idea, due to Marshak and Bethe (Phys. Rev. 72, 506 (1947)), that the mesons of the hard component at the sea level are generated in high altitudes through the decay of some heavier particles (now known as π mesons) has not yet been directly confirmed. The authors, working at the University of Chicago, constructed a stratospheric instrument that will permit the identification (π or μ) of locally produced mesons, and of the nature (charged or neutral) of the generating primary. It consists of an iron "generator," a magnetic lens (described by Bernardini et al. in Phys. Rev. 68, 109(1945)), a graphite absorber and various groups of counters for the selection of events.

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6637 Latitude Effect on the Nucleonic Component of the Cosmic Radiation. P. Caldirola and G. Zin. Nuovo cimento 7, 575-88(1950) July 25. (In Italian)

A computation is made of the effect of the latitude cutoff in the distribution of the nucleonic (protonic, neutronic, and total) component of the cosmic radiation in the atmosphere. It is assumed that the primary radiation at the limits of the atmosphere consists of protons with an integral energy proportional to E^{-2}, and that the mesons are created according to a "plural" model previously suggested by one of the authors (Caldirola, Nuovo cimento 6, 565(1949)). The results are compared with those derived by other authors and with experimental data. (auth)

6638 Mean-Free Path of Ionizing Particles of Cosmic Radiation in Photographic Emulsions. L. Bagalà, M. Merlin, and G. Puppi. Nuovo cimento 7, 525-6 (1950) July 2. (Letter to the editor; in Italian)

A considerable difference in numerical results obtained by various authors characterizes the recent determinations of the mean-free path of ionizing particles of cosmic rays. These discrepancies are mainly attributable to differences in methods. A more critical analysis of a given method and the use of various computational approaches to it are, therefore, desirable. The authors use the photographic emulsion method in the following way: the mean free path is computed as a function of (1) the probability of creation of a double star and (2) the mean length of the track between the centers of a double star. These distances between centers were measured on 32 double stars, from a total of 4360 stars obtained in horizontal plates at 4550 m altitude; as a result, the mean-free path of observed ionizing particles, assumed to be protons, was found to be 44 cm, or 175 g/cm².

6639 On Angular and Lateral Structure Functions of Extensive Showers. A. Borsellino. Nuovo cimento 7, 700-02(1950) July 25 (Letter to the editor; in Italian)

The only detailed calculations relative to the structure of extensive showers is attributed to Molière (in Cosmic Radiation, edited by Heisenberg, New York, 1946; Phys. Rev. 77, 715(1950)); beginning with a numerical computation of the Fourier transformations of angular and lateral distributions of particles of a given energy, he arrives at the values of integral distributions at the shower's maximum. By extending a procedure recently employed for the calculation of the mean scattering of electrons and photons in a shower (Nuovo cimento 7, 638(1950)), the present author shows how the Fourier transformations of the distribution functions at any depth can be obtained without recurring to numerical integrations.

6640 Observations on Atmospheric Cosmic-Ray Showers Wider than 1000 m. G. T. Zatsepin, I. L. Rozental', V. P. Zakharova, N. G. Khrebet, and G. B. Khristiansen. Doklady Akad. Nauk S.S.S.R. 74, 29-32(1950) Sept. 1. (In Russian)

Very wide atmospheric showers were studied at 3860 m using a method proposed by Skobel'tsyn and Zatsepin (Doklady Akad. Nauk. S.S.S.R. 73, 1157(1950) as a decisive test of the hypothesis on the special structure of these showers. A hodoscopic group of counters was placed midway between two groups of counters distant 1000 m from each other. Anticoincidences, marked by the silence of the central group when the lateral ones recorded coincidences,

were counted. The high percentage of anticoincidences observed proved that the structure of these showers was essentially different from that described by the cascade theory of the usual atmospheric showers.

6641 On the Coulomb Scattering of μ Mesons by Light Nuclei. E. Amaldi, G. Fidecaro, and F. Mariani. Nuovo cimento 7, 553-74(1950) July 25.

Using a "one-particle model" of the nucleus, the Coulomb scattering of μ mesons by light nuclei is treated in the Born approximation. As in the case of x rays or the slow-electron scattering by atoms, a distinction is made between coherent and incoherent scatterings. With the aid of a parabolic-well model, it is possible to derive, in an elementary way, an expression for the coherent-scattering cross section, which is an extension of the known Williams formula; it can be used for the case of high-energy μ mesons, where the related wavelength is comparable with the distance between protons in a nucleus. Spectra of the incoherently scattered μ mesons are derived in a similar way. The effect is considered of a finite value of the electromagnetic radius of the proton on both coherent and incoherent scatterings. (auth)

6642 On the Scattering of Photons in a Shower. A. Borsellino. Nuovo cimento 7, 638-54(1950) July 25. (In Italian)

Neglecting ionizations, angular and lateral spreads of photons in an extensive shower are calculated as a function of the depth. Use is made of Landau's diffusion equations (J. Phys. U.S.S.R. 3, 237(1940)) and of the Mellin-Laplace-Fourier transformations. For electrons, this procedure leads, in a more direct way, to results previously obtained by the author (Nuovo cimento 6, 543(1949)) with the aid of Nordheim's method (Phys. Rev. 59, 920 A(1941)). For both photons and electrons, it is found that the r.m.s. spread (averaged on the depth) is equal to the spread at the shower's maximum. If the soft component is assumed to be generated at all altitudes through the disintegration of neutrettos, the above result may explain the quasi-equality between distributions observed by Cocconi et al. (Phys. Rev. 76, 1020(1949)) and the distribution at the maximum as evaluated by Molière (Z. Physik 125, 250(1949)). (auth)

6643 On the Transition Effect in the Phenomenon of Star Production by Cosmic Radiation. E. Amaldi, C. Castagnoli, A. Gigli, and S. Sciuti. Nuovo cimento 7, 697-9(1950) July 25. (Letter to the editor; in Italian)

According to Bernardini et al. (Phys. Rev. 74, 845 and 1878 (1948)), a transition effect is observed in the production of stars by cosmic rays in photoemulsions. This view was contested by George et al. (Proc. Phys. Soc. (London) 62, 243 (1949)), but confirmed by Cortini et al. (Nature 165, 992(1949)). The present authors used another experimental approach, viz., the counting of those pulses, produced in any one ionization chamber (in a group of four), which corresponded to energies exceeding 5.3 Mev; events recorded by simultaneous pulses in two or more counters were neglected, as possibly due to showers. The resulting curve reveals qualitatively the presence of a transition effect for small energy stars.

6644 Structure of Abnormally Extensive Atmospheric Showers of Cosmic Radiation. D. V. Skobel'tsyn and G. T. Zatsepin. Doklady Akad. Nauk S.S.S.R. 73, 1157-60(1950) Aug. 21. (In Russian)

At 3860 m altitude, the authors had observed (Phys. Rev. 71, 315(1947)); Doklady Akad. Nauk S.S.S.R. 67, 45 and 255 (1949)) very extensive showers (up to 1000 m diameter) whose structure appeared to differ from that of the ordinary atmospheric showers; instead of one central dense trunk, they revealed the presence of several such trunks. Since Cocconi (Phys. Rev. 72, 350(1948)) contested that view, a crucial experimental setup is proposed here. To the two counter groups, separated by a distance of 1000 m, used in the previous work, a third group, placed in the middle, is now added and is used to record anticoincidences with the outer groups working in coincidence. In the case of an ordinary extensive-shower structure, the probability of such anticoincidences, as deduced from the cascade theory, is practically equal to zero. The experimental work based on the application of this method was done by Zatsepin et al. (Doklady Akad. Nauk S.S.S.R. 74, 29(1950)).

6645 A Portable Electronic Pile Kinetic Simulator. Walter Pagels. AECD-2941, Apr. 3, 1950. Decl. Sept. 18, 1950. 22p.

The theory of operation, circuit drawings, and a photograph of the simulator are presented. The procedure followed in the reactor simulator design is to synthesize an electrical network to fit equations describing the pile operation, so that the voltage output represents the solution for the unknown quantity n.

6646 Aerosol Indicator for Rapid Testing of the Dust Content of Air. G. Ljunggren and T. Wilner. Eng. Dig. 11, 309-10, 320, 326(1950) Sept.; Tek. Tid. 80, 551-2(1950) June 10.

Apparatus is described which indicates directly the dust content of air. Operating in the same way as an ultramicroscope, it allows observation of dust particles ranging down to 0.5 μ. (auth)

6647 Certain Properties of Electrostatic Fields Encountered in Electron Lenses. P. A. Lindsay. Proc. Phys. Soc. (London) 63B, 699-708(1950) Sept. 1.

The equipotential lines in a bipotential electron lens exhibit a fine structure which is revealed by application of the relaxation method to the solution of the Laplace equation in cylindrical coordinates. The asymmetry of the potential field between the two edges of the cylinders is confirmed by the same method and is established to be of the order of 2% in one particular case. (auth)

6648 The Design of a Versatile Low-power Periscope. Theodore R. Whitney, Roger S. Estey, and Lawrence W. Nichols. Naval Ordnance Test Station. NAVORD-1222, Mar. 20, 1950. 13p.

A periscope is described which permits an operator to view remote-controlled operations from a position behind protective barriers. Line of sight from the objective can be directed through 180 degrees horizontally and 75 degrees vertically by the operator. The optical system and mechanical components are of a configuration that permits the periscope to conform to many contours differing both in length of path and location of corners. Optical resolution is good enough to allow the reading of dial instruments in the object plane. (auth)

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6649 ...Evaluation and Rerating of Electronic Components... Eighth Interim Engineering Report; February 28, 1949, to April 28, 1950. R. L. Davis, A. T. Maierson, R. K. Crooks, R. E. Keppler, E. Zoltanski, R. L. Merrill, C. F. Rains, and R. C. McMaster. Battelle Memorial Institute. NP-1680, Apr. 28, 1950. 48p.

Lists of characteristics for the following components have been prepared: indicating instruments, relays, transformers, (intermediate and radiofrequency, pulse, and instrument). These lists are included in this report as Appendixes I, II, and III, respectively. A tentative code for components has been organized to establish relationships among components for the filing system. It is based upon fundamental concepts with provisions for recording data on other components in the future. Examples are: components in which the movement of charges (current) is the prime consideration, devices that convert energy as an ultimate function, etc.

6650 An Instrument for Chromatography and Chemical Analysis in Ultraviolet Rays (Ultrachemiscope). E. M. Brumberg. Doklady Akad. Nauk S.S.S.R. 72, 885-8(1950) June 11. (In Russian)

In previous papers (Doklady Akad. Nauk S.S.S.R. 25, No. 6 (1939); 69, No. 6(1949)) the author has described several methods of microchemical analysis and chromatography in ultraviolet light, in which visible color shadows, reflecting the character of absorptions in the ultraviolet, were obtained with the aid of fluorescent screens. A description is given here of a simple instrument serving similar purposes. In front of a Hg lamp, emitting light of 253 mμ wavelength and longer, are placed (1) a dark-purple glass plate absorbing the visible and transmitting in the range 410 to 240 mμ, (2) the filter paper bearing the chromatographic diagram or the spot left by the chemical drop analysis, and (3) a fluorescent screen. The screen is a glass plate with three thin layers of substances differing in fluorescence and absorption spectra in such a way that, as a result of mutual absorption, only rays of 400 to 320, 320 to 270, and <270 mμ traverse, respectively, the three layers, and the outcoming fluorescence is a mixture of the three fundamental colors, viz., red, green, and blue. As a consequence, the absorption in the chromatographic spots produces shadows upon the screen whose colors can be used as characteristic signs of the separated substances. The author is working at present on a procedure that will permit the use of shorter (<250 mμ) wavelengths; the chromatographic diagram (or the initial mixture) is "developed" with the aid of reagents transforming the original substances into others that absorb the ultraviolet (e.g., amidoacids are transformed into benzoyl derivatives).

6651 A Portable Pulse Generator for the Analysis of Coincidence Circuits. M. Conversi. Nuovo cimento 7, 674-6(1950) July 25. (In Italian)

A pulse generator is described, to be used for analyzing data of coincidence-recording circuits, especially those concerned with lagged coincidences. As in other similar instruments, two pulses separated by a variable time interval are observed with the aid of a synchroscope. The advantage of the present type lies in its small dimensions (18 × 25 × 25 cm).

6652 Quarterly Progress Report. October - December 1949. MIT Laboratory for Nuclear Science and Engineering (and Servomechanisms Laboratory). Jan. 1, 1950. 25p. (AEC File No. NP-1566)

Work is reported on the following: preparation of targets for fast neutron work with a Van de Graaff generator; capture gamma ray measurements; neutron deceleration and diffusion; determination of neutron energies in the resonance regions by time of flight measurements using coincidence circuit techniques; experimental determination of the effect of ducts of various shapes on the cyclotron shielding wall; design, procurement, test, and installation of components of the Rockefeller generator; a model of proton-resonance equipment to give control of an analyzing magnetic flux; fission chambers; development of fast coincidence circuits; design and construction of a rectangular pulse generator with a rise time of about 3×10^{-9} sec; use of a cathode-ray tube unit as the base for a synchroscope; a program to evaluate presently available pulse height discrimination circuits; and measurements with a spherical ionization chamber.

6653 Reduction of the Spherical Aberration of Magnetic Electron Lenses. U. F. Gianola. Proc. Phys. Soc. (London) 63B, 703-08(1950) Sept. 1.

The dependence of the resolving power of the asymmetrical bell-shaped magnetic field on the lens parameters is examined for varying degrees of field asymmetry. It is shown that a high asymmetry index favors high resolution, and a preferable value of lens power is specified. By suitably reinforcing the lens field with that of a small air-cored coil, the theoretical resolving power of the lens is increased. On account of the small size of the coil, the coil current must be pulsed intermittently if an appreciable reinforcing field is to be produced. The basic factors governing the design and operation of a suitable coil are discussed. (auth)

6654 Isotope Effect in Superconductivity. J. Franklin Inst. 250, 358(1950) Oct. (Note from the National Bureau of Standards) (See also NSA 4-3997 and 4-5940)

Recent low-temperature experiments conducted by Dr. Emanuel Maxwell of the National Bureau of Standards have resulted in the discovery of a relationship between superconductivity — the loss of electrical resistance at very low temperatures — and the constitution of the atomic nucleus. It was found that a pure mercury isotope Hg^{198} becomes superconducting at a temperature about 0.02°K higher than does natural mercury, which is a mixture of five different isotopes having an average atomic weight of 200.6. As the difference between the isotopes depends entirely on their nuclear masses, this shift, which is proportionately quite large for a temperature so near absolute zero, indicates that the nucleus must exert an important effect on the superconducting properties of the metal.

6655 Nuclear Data. NBS Circular 499. Katherine Way, Lilla Fano, Millicent R. Scott, and Karin Thew. Washington, National Bureau of Standards, 1950. 309p.

The Nuclear Science Group of the National Bureau of Standards, with the assistance of many other groups and individuals, has compiled a thorough tabulation of the nuclides and of a great many of their properties, as of January 1950. The philosophy behind the compilation has been that it should be primarily a tool for active workers in the field of nuclear physics rather than a list of "best values." Therefore, sev-

eral values by different workers have been included where available, along with a complete list of references.

6656 Purification of Heavy Isotopic Nitrogen N_2^{15} in a Thermal-Diffusion Separation Column [Trennrohr]. K. Clusius. Angew. Chem. 62, 366(1950) Aug. 7. (In German)

This paper is reproduced here in its entirety.

Nitrogen is known to have two isotopes, N^{14} and N^{15}. In atmospheric nitrogen the mixed molecule $N^{14}N^{15}$ is found in addition to N_2^{14} and N_2^{15}. The gaseous raw material for isotope separation consists principally of $N^{14}N^{15}$ with negligibly small amounts of N_2^{15}. Separation in a thermal diffusion column (trennrohr) gives N_2^{14} at one end of the tube and $N^{14}N^{15}$, containing only 50% of heavy isotope, at the other end. An equilibrium such as that of hydrogen isotopes in the presence of a catalyst, $2HD \rightleftarrows H_2 + D_2$, is not attained. In order to approach the condition of the equilibrium $2N^{14}N^{15} \rightleftarrows N_2^{14} + N_2^{15}$, spark discharge gaps were installed in several locations in a 27-m-long, 2000-stage separation column. About 1 cc of the heavy molecule N_2^{15} may be obtained by this method from 10 to 15 liters of entering nitrogen. An analysis by band spectroscopy indicates 99.85% N_2^{15} against 0.38% N_2^{15} in the initial gas. This is the purest heavy nitrogen obtained to date. The great separatory power of the apparatus was demonstrated by the separation of the three neon isotopes, Ne^{20}, Ne^{21}, and Ne^{22}. Natural neon contains the following percentages of these isotopes: Ne^{20}, 90.00%; Ne^{21}, 0.28%; and Ne^{22}, 9.72%. After the separation, Ne^{20} was highly enriched, containing 99.94_7% Ne^{20}, 0.01_5% Ne^{21}, and 0.03_8% Ne^{22}.

6657 Interval Estimation of a Linear Form of Means of Normal Population of Unknown Variance. A. de la Garza. K-664, Sept. 6, 1950. 16p.

An exact solution is given to the problem of the interval estimation of a linear form of the means of normal populations of unknown and not necessarily equal variance. The problem is of particular practical interest in the following: (1) stating confidence intervals on the difference between two means, and (2) pooling sample means and stating confidence intervals on the pooled mean. (auth)

6658 Penetration and Diffusion of X-rays. VII. Calculation of Space Distributions by Polynomial Expansion (Interim Report). L. V. Spencer and U. Fano. National Bureau of Standards. NP-1679, nd. 33p.

The expansions of the space distribution of x rays in suitable systems of polynomials appear to converge rapidly. Calculations are performed for various source geometries in an infinite homogeneous medium. The good convergence of this method of calculation is discussed with a view to its possible use in a variety of problems.

6659 Scintillation Counting with an E. M. 5311 Photomultiplier Tube. James S. Allen and Theodore C. Engelder. Los Alamos Scientific Laboratory. AECU-938, Sept. 12, 1950. 6p.

The EMI 5311 photomultiplier tube differs from the usual tube in that the electrodes are of the Venetian blind type rather than sections of electron optical lenses. This type of tube has been used as a scintillation counter with trans-stilbene crystals. The shape of the scintillation pulse is characterized by a rise time of 7.2×10^{-9} sec and a decay time of 1.8×10^{-8} sec. It is concluded that this type of multiplication structure results in an unusually large spread in the transit time of electrons moving through the structure. (auth)

6660 Fission Cross Section of U and the Discrimination between Various Tracks in Photographic Emulsions. Ch. Haenny, P. Lerch, and O. Rochat. Verhandl. der schweiz. naturforsch. Ges., 97(1949). (In French)

This is a summary of a work described by one of the authors (Rochat) in Mem. soc. Vaud. sci. nat. 9, 195(1949). The article referred to has been abstracted in Nuclear Science Abstracts as abstract 4-2783.

6661 Portable Counter for Radioactivity. Anal. Chem. 22, 25A(1950) Sept.

The article is reproduced here in its entirety.

The availability of a new monitor for checking all types of electromagnetic radiation has just been announced. This new count-rate meter is battery-operated and uses a thin-mica-end-window probe with a density of only 1.4 mg/cm². This window is roughly equivalent to 1.5 cm of air and the instrument may, therefore, be used for monitoring α rays as well as β and γ rays. The meter at one end of the instrument reads directly in counts per minute and, for γ rays, in milliroentgens per hour. For monitoring large quantities of radiation, the instrument is provided with three ranges and a selector switch, permitting a choice of 0.2, 2, or 20 mr/hr full scale. Headphones, which may be used for listening to the indication, are also furnished. A metal cover on the end of the counter permits the unit to be used for gamma surveying only. (auth)

6662 Pulse Spectrograph with 99 Channels. E. Gatti. Nuovo cimento 7, 655-73(1950) July 25. (In Italian)

A 99-channel analyzer of the Wilkinson type (Proc. Cambridge Phil. Soc., July 1950), for the recording of intensity spectra of potential pulses, is described. Through an extensive use of electronic relays, higher counting velocities and wider application ranges are obtained. Numerous circuit diagrams are shown.

6663 Experimental Work with Atomic Piles. T. M. Fry. Nature 166, 506-7(1950) Sept. 23.

A brief report is given of the information contained in the papers presented before the Mathematics and Physics section of a British Association meeting at Birmingham, England, on "The Application of Atomic Piles to Experiments in Nuclear Physics." The radioactive properties of the neutron, energy levels of nuclei, neutron cross sections, neutron diffraction spectroscopy, and physical changes caused by neutrons are very briefly discussed.

6664 Influence of Source Characteristics on the Distribution of Thermal Neutrons in a Multiplying Medium. S. Gallone and C. Salvetti. Nuovo cimento 7, 626-37 (1950) July 25. (In Italian)

In a previous paper (Nuovo cimento 7, 482(1950)) the distribution of thermal neutrons in multiplying media was studied for the case when the energy of the injected neutrons was lower than that of the fission neutrons. In the present note the reverse case is examined. Corrections are discussed which account for the effect of the mean free path of newly

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generated neutrons on the density of thermal neutrons and on the asymptotic behavior of that density.

6665 Symbolic Calculation Methods Relating to the Multiplication of Neutrons. S. Gallone and C. Salvetti. Nuovo cimento 7, 482-500(1950) July 2. (In Italian)

The problem is investigated of the density distribution of thermal neutrons in a subcritical medium comprising fissionable material and a moderator and containing a fast-neutron source. A short outline of the mechanism of the neutron multiplication precedes the description of methods for the treatment of this problem, which are based on a certain symbolic form for the solution of the equation of slowing down of neutrons with simultaneous diffusion (the fundamental equation of "age theory"). Those methods permit the study of various problems concerning multiplication in media both of various finite shapes and of infinite extension; the latter case is interesting in view of an application of the "image" method. Of practical interest is the case of a cylindrical column of finite height injected by a fast-neutron point source; readily converging solutions are obtained. (auth)

6666 Angular Correlation between Successively Emitted α Particles and γ Quanta. A. Z. Dolginov. Doklady Akad. Nauk S.S.S.R. 73, 1149-51(1950) Aug. 21. (In Russian)

Following Yang (Phys. Rev. 74, 764(1948)), who has derived certain general characteristics of angular distributions of particles emitted during nuclear reactions, the author examines the angular correlation between an α particle and a γ quantum in successive emissions. An expression is obtained giving the probability of a multipole γ emission as a function of the angle between the γ ray and the direction of a preceding α emission, the parameters being (1) the multipole order, (2) the nuclear angular moments in the initial, intermediate (after the α emission), and final (after the γ emission) states of the nucleus, and (3) the probabilities of emission of α particles of all possible orbital moments of equal parity. The correlation between the two emissions is the more apparent, the larger is the angular moment of the intermediate nucleus and the larger are the relative changes of the moments during the transitions. Kul'chitskiĭ (Doklady Akad. Nauk S.S.S.R. 73, 1153(1950)) found a well defined correlation in the transformation ThC → ThC", thus showing the inadequacy of assumptions on angular moments involved here, which have been advanced by Ellis et al. (Proc. Roy. Soc. (London) 139, 369 (1933) and Oppenheimer (Proc. Cambridge Phil. Soc. 32, 328(1936)).

6667 An Attempt at an Analysis of the Structure of Atomic Nuclei. M. A. Levitskaya. Doklady Akad. Nauk S.S.S.R. 74, 37-40(1950) Sept. 1. (In Russian)

An empirical study of isotope tables revealed certain regularities in the order according to which neutrons and protons are added to a nucleus of a given Z, (Z = x), when passing to its isotopes and to isotopes of the nucleus Z = x + 1. In the increasing order of Z, the series of elements can be subdivided into segments obeying the following rules. In a given segment, the basic order of addition, n, n, p, p, by which successive α groups are formed is interrupted after a number m of such groups has been reached; after that, the addition order is changed until the end of the segment. The general formula of a segment is $m\alpha + qn$, the characteristic values of q and m being

$$q = 2, 4, 6, 8, 10, 12, 14, 16, 18$$

$$m = 10, 14, 16, 18, 20, 22, 24, 25, 28$$

There is a correspondence between the successive segments thus defined and the shape of the distribution curve of nuclear quadrupole moments with varying Z, as given by Gordy (Phys. Rev. 76, 139(1949)).

6668 Correlation between the Directions of α and γ Emissions in the Transformation ThC → ThC". L. A. Kul'chitskiĭ. Doklady Akad. Nauk S.S.S.R. 73, 1153-6 (1950) Aug. 21. (In Russian)

Using the coincidence method, measurements were made of the angular correlation between α particles emitted by ThC (Bi^{212}) in the transition to the first excited level of ThC" (Tl^{208}) and the subsequent emission of 40-kev γ quanta. A maximum number of coincidences was observed at 45 deg. An attempt was made to deduce information on the nuclear angular moments and level parities involved, by using Dolginov's formula (Doklady Akad. Nauk S.S.S.R. 73, 1149 (1950)) which gives the angular distribution in terms of the multipole order of the emission, the three nuclear angular moments (initial, intermediate, and final), and the parity of the orbital moments. The existence of a maximum at 45 deg excluded a dipole emission, but gave the following combinations of the successive angular moments for a quadrupole emission: 0-3-1, 1-2-1, and 2-3-2. Although none of the corresponding theoretical curves for the angular distribution coincided with the experimental one, the general trend was the same. A very good agreement is obtained when the theoretical curve represents the sum of the combinations 1-2-1 and 1-3-1; thus, the first excited state of ThC" has, probably, two close sublevels with different angular moments.

6669 The Magnetic Moment of the Proton. J. de Boer. Nederland. Tijdschr. Natuurk. 15, 293-306(1949) Dec. (In Dutch)

An account is given of the determination of the magnetic moment of the proton by Taub and Kusch (Phys. Rev. 75, 1481(1949)). This latter work has been abstracted in Nuclear Science Abstracts as abstract 3-151.

6670 On the Theory of Nuclear Shells. D. Ivanenko and A. Sokolov. Doklady Akad. Nauk S.S.S.R. 74, 33-6 (1950) Sept. 1. (In Russian)

An approximate general formula is derived for the "critical" numbers N of nucleons completing successive nuclear shells as a function of the nucleonic density ρ. The statistical method of Fermi, which had already been employed for the approximate deduction of critical numbers of electrons in an atom, was followed. The statistical model leads directly to the formula $N = (2l + 1)^3/24\ \pi^3 r^3 \rho$. Assuming a certain distribution of ρ, the N's are obtained successively for l = 0, 1, 2, 3, etc. By taking ρ = constant, for heavy nuclei, one gets N = 0, 1, 2, 6, 12, 24, 38, 60, 86, 122 ... If, for light nuclei, ρ is assumed to vary continuously in space, the numbers obtained are N = 2, 10, 28, 60, 110... The assumptions having an approximate, preliminary value only, the results should be regarded as giving only a certain general answer to the problem. Corrections, such as that for the Coulomb interaction between protons, or that for the effect of the surface

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layer, could be introduced. Valente (Phys. Rev. 78, 77(1950)), in an analysis of the empirically known series of "magic" numbers, obtained the formula $N = l^3 + 5l)/3$ which is related to that given above.

6671 Pile Modulation and Statistical Fluctuations in Piles. W. G. L. Brownrigg and D. J. Littler. Atomic Energy Research Establishment. AERE-N/R-476, January 1950. 43p.

Measurements were made on the Graphite Low Energy Experimental Pile (Gleep) at Harwell of the statistical fluctuations in the number of neutrons in the pile. These measurements were made to determine the effect of the fluctuations on the accuracy of modulation measurements made with the pile. In the case where there were no fluctuations arising from the ion chamber which measures the pile neutrons, the measured fluctuations were found to agree with those predicted theoretically. When the ion chamber was far from the center of the pile, the chamber fluctuations became important. It was found, in this case, that the measurements were complicated by current noise in the resistor through which the chamber current flowed. However, after a correction had been made for current noise, the results again agreed with theory. A scheme using a boron coated chamber instead of a boron trifluoride chamber is suggested in order to improve the accuracy of measurements taken with the Gleep oscillator. (auth)

6672 Annual Progress Report: July 1, 1949, to Jan. 31, 1950. Spallation Reactions. Wade L. Callender, Bruce Dropesky, Charles C. Thomas, Jr., Genevieve Wagner, and Edwin O. Wing. University of Rochester. NYO-617(Del), nd. 6p.

The spallation products obtained from the bombardment of cobalt and aluminum with 250-Mev protons are being studied. Cr^{49}, Mn^{52}, Mn^{56}, Fe^{52}, Co^{55}, and Ni^{57} have been identified as spallation products of cobalt, and the presence of activities attributed to Be^7, F^{18}, and Na^{24} has been found in the bombarded aluminum. A discussion of other spallation products possibly present is given, and a proposed research program to study high-energy reactions in other elements is outlined.

6673 Measurement of the Cross Section of Uranium for Fission with Thermal Neutrons. U. Facchini and E. Gatti. Nuovo cimento 7, 589-605(1950) July 25. (In Italian)

A measurement was made of the cross section of U^{235} for fission with slow neutrons. Since the corresponding value for Li (in the reaction $Li^6(n,\alpha)H^3$) is well known, the ratio between the two values was determined by successively exposing samples of both elements to the action of a constant flux of thermal neutrons in an ionization chamber, and comparing the pulse counts. The number of U nuclei present in each sample was deduced from the number of α particles emitted, while the corresponding value for Li was found by accurate weighing of the samples. The results were $\sigma_U/\sigma_{Li} = 0.0596 \pm 2.5\%$, $\sigma_U = 3.97 \pm 0.12$ barns, and $\sigma_{U^{235}} = 551 \pm 17$ barns. (auth)

6674 Methods of Study of Arc Discharges in Uniform Magnetic Fields. Raymond Murray. Y-632, Aug. 11, 1950. 152p.

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The importance of selective and efficient ionization in arc sources for high-energy accelerators, as well as in the mass-spectrographic separation of stable isotopes, gives a high value to the study of the arc discharge in a magnetic field. Means of eliminating variable electron currents to the arc by preliminary definition of the electron stream and monitoring of the current to the insulated arc chamber have been demonstrated. The anode probe was found to be a successful means of measuring electron currents. The interpretation of probe currents as a function of potential in terms of a first derivative analysis was shown to be superior to the conventional second derivative analysis. Of the several physical models of the arc discharge that were studied, a superposed Maxwellian distribution of electron speeds on a distribution due to electron scattering by gas molecules was found to be the most appropriate. The plasma potential was shown to be successfully measured mass-spectrographically. The breakdown of the method at high gas pressures, high magnetic fields, and large arc currents can be ascribed to the fact that ion collisions cause a reduction in energy. The relative proportions of hydrogen and deuterium atomic and molecular ions were measured mass-spectrographically at various magnetic fields. A statistical computation of expected ion abundances based on the proportions of hydrogen and deuterium in the electrolytic cell, in the evolved gas mixture, and in the arc column, and on the probabilities of collision and formation by combination of ions, was found to agree very well with the observed distributions. The existence of collisions was demonstrated, and the nature of the ionic reactions established. In particular, it is evident that the interchange $H_2^+ + H_2 \rightarrow H_3^+ + H$ is the dominant reaction and that it involves the dissociation of the H_2^+ ion rather than that of the H_2 molecule.

6675 Determination of the Pole Faces of a Betatron by a Model. J. J. Orlin. Univ. Bergen Årbok 1949, No. 5, 1-9(1950).

The problem of determining the shape of the pole faces of a betatron under construction in Bergen, Norway, was solved by constructing a small model of the electromagnet (in the scale 1:4) and exploring the latter's field with the aid of a search coil.

6676 The Recovery of Tritium Used in Ion Accelerators. D. L. Allan, J. Carey, J. F. McCahon, and M. J. Poole. Atomic Energy Research Establishment. AERE-N/R-494, Mar. 1950. 8p.

The tritium gas admitted to the ion source of a high-voltage particle accelerator to produce a triton beam may not be discharged into the atmosphere because of its expense and high radioactivity. A system for the quantitative recovery of this tritium gas is described in this report.

6677 Synchro-Cyclotron Technical Report No. 6, ¾ Scale Model Oscillator Report. E. M. Williams, L. W. Johnson, and H. M. Collins. Carnegie Institute of Technology. August 1, 1950. 7p. (AEC File No. NP-1823)

The essential features of construction of the final version of the three-quarter scale model oscillator for the Carnegie Institute of Technology synchro-cyclotron are shown in drawings and photographs. Results of tests yielding the highest dee voltage are shown for a frequency range corre-

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sponding to 19 to 32 Mc in the full-scale model, except that the limits are 5% higher than they should be for the scale factor used. For pulsed operation with a 50% duty cycle the test results indicate an input of 75 kw at 12.5 kilovolts, which is practicable with the power supply available.

6678 The Traveling-Wave Linear Accelerator. E. R. Wiblin. Science 112, 399-400(1950) Oct. 6.

Electrons are introduced axially into a special form of evacuated radio wave guide, along which electric waves are made to travel so that their phase velocity increases steadily from a speed equal to that of the entering electrons up to nearly that of light. Most of the electrons are then constrained into "bunches" moving in constant phase relationship to the waves and are, therefore, accelerated with them. In the accelerator recently installed at the Atomic Energy Research Establishment at Harwell in southern England, the final electron energy obtained may be as high as 3.2 Mev with a mean current of about 120 μa. The electrons may be extracted from the machine by allowing them to emerge through a thin metal "window" at the end of the accelerating wave guide. A description of the use of a magnetron valve is included. A method for calculating neutron velocity is described.

6679 Neutron-Proton Scattering at 90 Mev. Robert Hamlon Fox. UCRL-867, Aug. 14, 1950. 33p.

Previous experiments on neutron-proton scattering with 90-Mev neutrons have ruled out the symmetrical theory of central forces between nucleons and have required the inclusion of a tensor potential. This is in agreement with the existence of the quadrupole moment of the deuteron. There is, however, one feature of the 90-Mev angular distribution which appears to warrant further investigation. This is the apparent existence of a high peak at 180 deg in the center-of-gravity system. Such a sharp peak would represent a long tail of appreciable depth in the potential. The angular distribution of the differential cross section in the neighborhood of this peak has now been investigated in greater detail. A detecting system was built up which had improved angular and energy resolutions. Scintillation counters were used instead of proportional counters because of their greater speed. This made it possible to use the full beam intensity at all times in spite of the low coincidence-singles ratio occasioned by narrowing the acceptable energy interval from 66 to 130 Mev to 85 to 95 Mev. Measurements were made at 10 and 25 deg in the laboratory system as well as from 1 to 5 deg. It now seems well established that there is no high peak at 180 deg and that, therefore, the range of the interaction is not much greater than the usual nucleon radius.

6680 Some Effects of Nozzle Design on the Diffraction of Electrons by Gases. R. B. Harvey, F. A. Keidel, and S. H. Bauer. J. Applied Phys. 21, 860-74(1950) Sept.

An evaluation has been made of some of the errors introduced into the electron diffraction of gases by failure of the sample to be localized, and by secondary and higher order scattering. The degree to which poor nozzle design may contribute to these factors was investigated experimentally by measurements of the pressure in a camera and absorption measurements of the main electron beam when a small volume of gas was allowed to expand into the camera, and investigated theoretically for the cumulative effects of higher order scattering on the final picture. This evidence was complemented by density measurements on photographic plates taken under similar conditions. The effect of using liquid air-cooled surfaces around the nozzle was tested. Of the nozzles tested, better "image to background" ratios were obtained with the "hydrodynamic" and "comparison" nozzles than with the "conventional" nozzle, but the gas must be admitted slowly enough so that less than about 10% of the main beam is appreciably scattered. The "image to background" ratios were always higher using adequate cooling on the condensing surfaces surrounding the nozzle. In the case of pressure and electron beam absorption measurements, short exposures were advantageous, where secondary scattering was not directly considered, and high camera pumping speeds were always advantageous. On the basis of these results some general design suggestions for electron diffraction cameras, and requirements for good efficiency in nozzles can be made. A nozzle design is proposed which would reduce materially the errors normally encountered in electron diffraction work. (auth)

6681 The Isotopes of Americium. K. Street, Jr., A. Ghiorso, and G. T. Seaborg. AECD-2931, Apr. 11, 1950. Decl. June 2, 1950. 7p.

This material was published as a letter to the editor in Phys. Rev. 79, 530-1(1950) Aug. 1, and was abstracted in Nuclear Science Abstracts as abstract 4-5780.

6682 Beta-Spectrum of Ne^{23}. H. Brown and V. Perez-Mendez. CUD-48, Apr. 14, 1950. 2p.

This material appeared as a letter to the editor in Phys. Rev. 78, 812(1950) June 15, and was abstracted in Nuclear Science Abstracts as abstract 4-4691.

The beta spectrum of Ne^{23} obtained by the $Ne^{22}(d,p)Ne^{23}$ reaction was investigated. Two groups of β particles were found with maximum energies of 4.21 ± 0.015 and 1.18 ± 0.04 Mev. Half-lives of 40.2 sec and 555 sec, respectively, were calculated for these from the observed value of 40.2 ± 0.4 sec and from the observation that the low-energy group was ~7% as intense as the high-energy group.

6683 Gamma-Radiation from Ne^{23}. V. Perez-Mendez and H. Brown. CUD-49, Apr. 14, 1950. 3p.

This material appeared as a letter to the editor in Phys. Rev. 78, 812-13(1950) June 15, and was abstracted in Nuclear Science Abstracts as abstract 4-5065. The γ rays associated with the soft component in the β disintegration of Ne^{23} were found and an energy of 3.0 ± 0.5 Mev and half-life of 38 ± 6 sec estimated for it. A level scheme is proposed and the states compared with predictions based on nuclear shell models.

6684 Note on Zero-zero Transitions. S. D. Drell. ORNL-792, Sept. 6, 1950. 13p.

A study of the effect of nuclear radius on rates of internal conversion and of electron-positron pair formation in the decay of a nucleus from an excited level of zero spin, with no parity change, is presented. The ratio of K- to L-shell conversion is calculated using M. E. Rose's (to be published) wave functions for relativistic Dirac electrons in the field of a finite charge distribution. This ratio is found to be independent of nuclear matrix elements and to agree, within 10%,

with the ratio as calculated for electrons in a point Coulomb field. Three cases of zero-zero transitions with no parity change that have been proposed in the literature, namely, internal conversion and pair formation from the 1.42-Mev transition in RaC′, (Po^{214}) pair formation from the 6.04-Mev transition in O^{16}, and internal conversion from the 0.7 Mev transition in Ge^{72} are discussed. 23 references.

6685 Statistics of the Lifetime of Atomic Nuclei and the Stability of Natural Elements. A. V. Trofimov. Doklady Akad. Nauk S.S.S.R. 74, 45-8(1950) Sept. 1. (In Russian)

The half-life of Re^{187}, 4×10^{12} years, is the longest known and is probably close to the limit of possible half-life determinations. Consequently, it is an open question whether the "stable" isotopes do not undergo, on earth, very slow decays. The author attempted an extrapolation of statistical curves of the distribution of 682 isotopes listed by Mattauch et al. (Isotopenbericht, 1949) according to their half life, in the range from 10^{-6} sec to 3.17×10^{12} years. All the curves, both total curves comprising all decay types or all atomic masses and special curves, have a maximum coinciding approximately with the half-life period of the neutron. An extrapolation up to 10^{22} years, a period even cosmically enormous, showed that, out of the known number of stable isotopes (>250), not more than 5 could be β emitters and not more than 10 could be α emitters; the remaining isotopes should be considered really stable under the present conditions on earth.

6686 Mechanism of the Loss of Energy by Collisions in a Material Medium (Part I). Mario Schönberg. Bull. centre phys. nucl. univ. libre Brux., No. 20, 1-50 (1950) Aug. 50p.

The energy loss in collisions and the emission of Cherenkov radiation by a particle in a material medium are investigated in detail. It is shown that the variation, with the energy, of the loss in distant collisions is essentially determined by the rate of emission of Cherenkov radiation, for relativistic energies. The mechanism of Bohr and Williams of (1) increase of the collision loss, at relativistic energies, by the relativistic contraction of the times of collision, and (2) the correlated increase of the radii of action for ionization and excitation, is shown to be incorrect, even in the case of gases, because of the neglect of the effects of the polarization of the medium. It is shown that the loss of energy by direct excitation and ionization, as well as the emission of the Cherenkov radiation, occurs always close to the path of the particle, at distances smaller than, or of the order of, the radii of action of the nonrelativistic Bohr theory. The rate of loss of energy in direct collisions, at distances larger than the atomic dimensions, and the spatial distribution of the loss are correctly described by the Bohr theory for nonrelativistic energies, but are practically independent of the energy in the relativistic region. At large distances the ionization and excitation are due to the absorption of Cherenkov radiation at high energies, and the spatial distribution depends essentially on the values of the absorption coefficient in the various bands of the Cherenkov spectrum. All the aforementioned qualitative features of the process of the loss of energy in a material medium can be established in a very general way, without taking into account the detailed properties of the dispersion model. The same is true for the saturation effect of Fermi. The formula of Halpern and Hall for the total loss of energy is generalized in order to allow the determination of the spatial distribution of the loss. The theory given in this paper is purely classical. An essential part is played by a method of solution of the Maxwell equations, in a dispersive medium, based on the generalization of the retarded and advanced potentials. (auth)

6687 On Statistical Models of Nuclei. G. Puppi. Nuovo cimento 7, 703-04(1950) July 25. (Letter to the editor; in Italian)

The known statistical model of the nucleus (Rosenfeld, Nuclear Forces, Chap. 13), which introduces, at a zero approximation (T = 0°K), independent particles described as plane waves, results in too low a value of the binding energy. In order to improve the situation, Euler (Z. Physik 105, 533 (1937)) has suggested taking into account the term of the second approximation. However, as shown by Watanabe (Z. Physik 113, 482(1939)), this involves a notable deformation of the total eigenfunction of the system. The present author proposes another approach to the problem, in which the excessive perturbation caused by the introduction of particle interactions at absolute zero is avoided by posing initial conditions at $T \neq 0$.

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6688 Medical and Health Physics Quarterly Report; April, May, and June 1950. University of California Radiation Laboratory. AECD-2928. July 26, 1950. Decl. Sept. 8, 1950. 63p.

Separate abstracts have been prepared on the following sections of this report: The Metabolic Properties of Plutonium and Allied Materials, sect.1; Biological Studies of Radiation Effects, sect.2; Health Chemistry and Physics, sect.3.

6689 The Nature of Streptomycin Requirement and Its Effects on the Genetics of Streptomycin Resistance in E. Coli. B. A. Rubin. Brookhaven National Laboratory. AECU-967. [nd.] 1p.

A brief discussion of some experiments on the dynamic aspects of bacterial populations using several types of streptomycin-resistant mutants is given. The prediction of mutation rate and type distribution and the effects of changes in medium and streptomycin level on the metabolism of sensitive, resistant, and dependent organisms are mentioned.

6690 Biological Studies of Radiation Effects, sect.2 of Medical and Health Physics Quarterly Report; April, May, and June 1950. J. H. Lawrence. University of California Radiation Laboratory. AECD-2928 (sect.2). July 26, 1950. Decl. Sept. 8, 1950. 15p.

Metabolism of C^{14}-labeled Glycine. C^{14}-labeled glycine may be safely administered to human patients because of the large and rapid excretion by way of the lungs as carbon dioxide and the smaller excretion by way of the urine and feces and the almost complete accountability in the excreted products for the labeled carbon. The changes in the activity following a single injection of C^{14} in the plasma protein is presented. The life span of the red blood cells of the first patient given C^{14}-labeled glycine was approximately 90 days.

The Metabolism of C^{14}-labeled Stilbamidine in Multiple Myeloma. A patient with multiple myeloma in whom the diagnosis was established by sternal puncture and the presence of multiple lytic lesions in the bone was given intravenously 60 mg of C^{14}-labeled stilbamidine. The indications are that over the 3-month period between injection and autopsy roughly 15% of the administered activity was excreted in the urine and possibly between 10 and 15% in the feces. By far the largest site of localization of activity in this patient occurred in the liver, where almost 70% of the activity was still present 3 months after administration.

Measurement of Total Body Water by Means of Tritium. The data obtained so far in total-body-water measurements are presented. The patient was given 1 cc of an isotonic solution of HTO containing approximately 2 mc of tritium. Blood samples were taken at 3, 6, and 24 hr following the administration of the tritium. The rate of disappearance of tritium from the plasma and the method of calculation of the total body water are shown.

6691 A Chemical Test for Seed Viability. Mary L. Koester. Brookhaven National Laboratory. AECU-802. [nd.] 4p.

Ionizing radiation has a lethal effect upon seeds if given in sufficient dose. In every experiment involving killing of seeds, it is usually necessary to test the germination of a certain number of seeds. However, viability can be determined much more quickly by using a chemical, 2,3,5-triphenyltetrazolium chloride, commercially known as TPTZ. After presoaking, each kernel is cut longitudinally so that the embryo is bisected medianly through its entire length and one-half of each kernel is submerged immediately in TPTZ. The viable kernels possess an embryo which is stained throughout, or at least stained in the regions of the coleoptile, plumule, secondary radicles, transition region, and scutellum.

6692 Acute Necrosis and Malformation of Developing Mammalian Brain Caused by X-ray. Samuel P. Hicks. Pondville Hospital, Walpole, Mass. AECU-949. [nd.] 9p.

In the course of an investigation of the pathologic effects of ionizing radiation on the development of the mammalian nervous system it was found that growing central nervous tissues in fetal rats and mice could be selectively and extensively destroyed by x radiation with virtually no destructive effect on other organs. Irradiation of pregnant rats and mice with 200 and 600 r to the whole body resulted in acute necrosis of the rapidly growing parts of the brain, spinal cord, and retinas of their fetuses. This developed within a few hours, was highly selective for the central nervous system, and was often severe and extensive at 200 to 600 r. At 150 r damage was less, and was followed in two days by malformations in the neuroblastic zones. Fetuses allowed to go to term and sacrificed after days or weeks showed severe maldevelopments of corpus callosum, hippocampus, striatum, and cerebral cortex. Extraneural lesions were absent below 200 r and rare at 400 r. Below 100 r no destructive lesions occurred.

6693 A New Concept and Studies of Capillary Hemorrhagic Diathesis. Alfred L. Copley. New York Medical College. AECU-950. [nd.] 9p.

The mechanisms affecting hemorrhage do not necessarily include disturbances in blood coagulation. Both hyper- and normal coagulability have been found in applying total-body x irradiation to rabbits. Large coagula were found in both sides of the hearts of rabbits treated with dicumarol and single doses of 700 and 800 r of x rays. The designation of a hemorrhagic agent such as dicumarol as a true blood coagulant is therefore erroneous. On the basis of observations including radiation-induced hemorrhage in rabbits, mice, rats, and hamsters, a new, more satisfactory concept of capillary hemorrhagic diathesis has been developed and is presented in schematic form. A new blood coagulation phase, the gelation of fibrin systems, has been found, and methods for its detection are reported. Micro and macro tests for the study of hemorrhage and hemostasis are briefly discussed.

6694 Corn Grass, a Dominant Monogenic Spontaneous Mutant and Its Possible Significance as an Ancestral Type of Corn [abstract]. W. R. Singleton. Brookhaven National Laboratory. AECU-953. [nd.] 1p.

Attempts have been made to induce reverse somatic mutations in Corn Grass, a spontaneous dominant mutation in corn, by x radiation, P^{32} radiation, or continuous Co^{60} irradiation. No such reverse mutations have occurred.

BIOLOGY AND MEDICINE

6695 Supernumerary Chromosomes in Diploid and Triploid Trillium Erectum L. [abstract]. A. H. Sparrow and Virginia Pond. Brookhaven National Laboratory. AECU-954. [nd.] 1p.

A brief statement is made concerning the high percentage of Trillium having supernumerary (or fragment) chromosomes. Since these chromosomes are small they may sometimes be confused with radiation-induced fragments. This hazard can be avoided in radiation experiments by proper screening of the material before or during the experiment.

6696 Air-Borne and Short-Wave Radiation Hazards in the Project at the University of California. H. F. Ballenger. University of California Radiation Laboratory. AECD-2858. Sept. 10, 1945. 27p.

This report brings together the results of approximately two years of study into the problem of detecting and eliminating sources of hazard due to the presence of toxic gases or vapors of uranium and its products and to radiation. The report is separated into two main divisions: first, a summation of the dust-, vapor-, and gas-hazard problem and second, a summation of the radiation problem. Methods of collection, analysis, and study of hazards for uranium dust, mercury vapor, and carbon monoxide are discussed. Methods for detection of radiation and methods to eliminate hazards of α and β particles, γ rays, x rays, and neutron flux are included.

6697 Health Chemistry and Physics, Sect.3 Medical and Health Physics Quarterly Report; April, May, and June 1950. N. B. Garden and B. J. Moyer. University of California Radiation Laboratory. AECD-2928 (sect.3). July 26, 1950. Decl. Sept. 8, 1950. 3p.

Health Chemistry. New processes have been developed which provide further safety features for handling radioactive materials. Work on monitoring, transportation of radioactive materials, decontamination, disposal, storage, and processing equipment is briefly reported.

Health Physics. Study of the fast-neutron fields outside the shielding of the 184-in. cyclotron has been continued. It has been found that the area survey meter in the region studied showed intensities closely correlated with the neutron intensities, and may therefore be used roughly as a neutron monitor for this region. A bismuth-fission ionization-chamber counter with efficiency increased at least tenfold over those formerly employed in high-energy-neutron research has been developed. A statistical summary of the monitoring program is given.

6698 Nomograms for the Calculation of Gamma Shielding. J. L. Balderston, J. J. Taylor, and G. J. Brucker. Kellex Corp. AECD-2934. Nov. 15, 1948. Decl. Aug. 16, 1950. 33p.

Nomograms are given with which one can calculate the shielding required for γ-ray sources at the geometries most commonly encountered: point, line, plane, slab, and sources subtending small angles. A discussion of these nomograms, analysis of errors involved, and a description in detail of the method of using the nomograms are included. An appendix lists the basic equations and determinants used in drawing them.

BIOLOGY AND MEDICINE

6699 H. I. Lecture Series, Part I. Hanford Engineer Works. AECD-2943. July 1, 1947. Decl. Aug. 2, 1950. 77p.

These lectures are part of the regular training course for men assigned to radiation protection duties. They are aimed primarily at those who have a technical degree; for example, B.S.Ch.E., or the approximate equivalent. The lectures are given under the following respective headings: scope of health instrumentation; fundamental concepts of nuclear physics; properties of the elementary particles; ionization of gases; G-M counters and other particle detectors; electrometers, scalers and related circuits; health instruments; radioactivity; fission and fission products; effects of radiation on the body; radiation dosimetry; tolerance dose; protection methods; special hazards bulletin No. 1; and other special hazards bulletins.

6700 Chemical Problems in Atomic Energy. S. Lawroski. Argonne National Laboratory. AECU-770. Nov. 29, 1949. 13p.

Some of the special techniques and precautions required in the processing of radioactive materials are discussed in light of past experience and their shortcomings noted. Areas in which improvement is needed are indicated. Recovery and decontamination of source and fissionable materials, recovery of useful by-product isotopes, processing of active waste streams for recovery of valuable chemicals and for concentration of radioactivity for storage, and corrosion resistance and decontaminability of construction materials are some of the areas discussed.

6701 Lecture Notes; Health Physics Training Lectures, 1948-1949. Oak Ridge National Laboratory. AECU-817. Sept. 29, 1950. 105p.

A series of lecture notes, issued in conjunction with lectures given during the fall of 1948 to persons working in the field of health physics at the Oak Ridge National Laboratory, are reproduced. The notes are essentially in the form written or approved by the lecturer. A discussion of the place of health physics in industry and the health-physics organization at ORNL is followed by a series of lectures on fundamental nuclear physics. Application of physics to health-physics and radiation-detection methods and techniques are covered in 20 lectures, and 14 lectures are given to applied health physics and practical problems.

6702 Radiologic Safety in Radiography with Isotopes. Thomas N. White. Los Alamos Scientific Laboratory. AECU-952. [nd.] 7p.

The main radiologic safety problems encountered in the use of radium and radioactive isotopes in radiography are discussed. Special attention is given to some problems in advance planning, tools and equipment, leak testing of radium sources, monitoring, and operational management that might not be apparent from reading the literature, or which are thought deserving of special emphasis. An appendix includes some detailed information on maximum permissible exposure, data for approximate exposure-rate calculations, and some sample problems. A selected bibliography is included.

6703 The Metabolic Properties of Plutonium and Allied Materials, sect.1 of Medical and Health Physics

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Quarterly Report; April, May, and June 1950. J. G. Hamilton. University of California Radiation Laboratory. AECD-2928 (sect.1). July 26, 1950. Decl. Sept. 8, 1950. 42p.

Radioautography and Histology. Studies on the histopathology of astatine, At^{211}, have continued following two lines: (1) the toxicity of the element to body tissues in general, and (2) the points of localization and destruction of thyroid tissue.

Tracer Studies in Rats with Radioactive Materials. Studies on the deposition of tantalum in rats using Ta^{182} as a radioactive tracer have been continued. In general, these studies show that tantalum is rather readily eliminated from the body. That which remains deposited in the body 64 days after administration is primarily found in liver and kidney, skeleton, skin, and the musculature. Carrier-free Re^{183} has been administered to rats intravenously and its fate studied for 1, 4, 24, and 48 hr. With the exception of a relatively large accumulation of this isotope by the thyroid, rhenium was not deposited to any great degree in any of the tissues studied. The fate of carrier-free Os^{185} has been studied in rats following intramuscular administration. One day following administration, relatively large amounts of osmium were found in kidney and in the intestinal contents, with lesser amounts being deposited in liver, blood, and spleen.

Chelating Experiments. Necessary characteristics of chelating agents for hastening excretion of radioactive material are discussed. In view of the importance of the toxicology of beryllium, a number of chelating agents were screened in vivo for possible use for removing beryllium which has been deposited in the body. Numerous cations have been tested for reaction with ethylenediamine tetracetic acid (EDTA) to form soluble chelates.

A Preliminary Report on the Effect of Whole-body Radiation on Extra- and Intracellular Electrolytes. Experiments have been aimed at establishing the pattern in rats of fecal and urinary excretion of electrolytes in acute radiation injury. Na^{22} was injected subcutaneously in an amount of 2.0 μc 36 hr before various irradiations. The reactions of the animals are described, and the change in Na^{22} concentration in tissues and excreta is presented.

Decontamination and Bone-Metabolism Studies. A study was made of the curves for distribution in rats of Ce^{144}, Nb^{95}, Y^{90}, and Pu^{239} during the first hour following intravenous injection. An initial rapid fall in blood level during the first 10 min was followed by a much slower decline. Treatment with massive doses of zirconium citrate prolonged the initial rapid rate of urinary excretion and fall in blood level. After injection of Ca^{45} into normal young rats, feeding a phosphorus-deficient diet resulted in an immediate and marked increase in the urinary excretion of radiocalcium, with accelerated removal from the skeleton. This procedure would appear to have possibilities for decontamination of radiostrontium.

The Effect of Calcium-Versene Complex on the Excretion of Radiocalcium in the Rat. Calcium-versene complex injected 0 or 15 min after administration of Ca^{45} resulted in a very significant increase in the urinary excretion of radiocalcium. This treatment also produced a small reduction in the amount of Ca^{45} in bone.

Radiochemistry. The 52.9-day Be^7, produced by (d,2p) reaction on lithium, was isolated by dissolving the target in water to give a solution of lithium hydroxide containing the Be^7 as a radiocolloid which is removed by passing the solution through a sintered-glass filter. The long-lived radioisotopes of tantalum, $Ta^{178,182}$, were prepared by α-particle bombardment of hafnium according to the reaction Hf(d,αpn)Ta. A carrier-free procedure was developed for isolating the radiotantalum from the hafnium oxide target material and from the radiotungsten concurrently produced by (α,xn) reaction. The shorter-lived radioisotopes of tantalum, $Ta^{176,177}$, were prepared by deuteron bombardment of HfO_2 according to the reaction Hf(d,xn)Ta. A more rapid procedure has been developed for the separation of At^{211} from bombarded bismuth foils. The bismuth is heated to 425°C in a stream of nitrogen carrier gas at a pressure of 10^{-2} to 10^{-3}mm. The At^{211} is collected on a cold finger which is covered with a thin layer of ice.

BIOLOGY AND MEDICINE

6704 The Influence of Blood Incompatibilities on the Measurement of Blood Volume by Cell-tagging Methods. J. L. Nickerson, M. I. Gregersen, W. S. Root, and L. M. Sharpe. Columbia University and Brookhaven National Laboratory. AECU-963. [nd.] 4p.

A preliminary study has been made of the effects on blood-volume measurements, as determined with Fe^{55}, CO, T-1824 dye, or P^{32}, of incompatibility of donor and recipient blood in transfusions in dogs. The cell-tagging methods are affected more than is the dye method and may underestimate the volume when incompatibility exists.

CHEMISTRY

6705 Protactinium Chemistry. R. E. Elson, J. C. Sullivan, M. H. Studier, and P. A. Sellers. Argonne National Laboratory. AECD-2896. Mar. 15, 1950. Decl. Mar. 15, 1950. 17p.

The paper, prepared for presentation at an ACS meeting, traces the chemistry of protactinium from its first discovery by Hahn and Meitner in Germany in 1917 to present day experimental work. Since the inception of the Manhattan District (later the AEC) additional work has been done on the chemistry of protactinium. Much of this, like the early work, was done on tracer levels or on impure material. What little has been done on pure protactinium in macroconcentrations is more in the nature of preliminary and exploratory experiments than completed work, and much still remains to be done.

6706 Hydrolytic Behavior of Metal Ions. II. Acidity of Thorium Tetrachloride Solutions. Kurt A. Kraus and Robert W. Holmberg. Oak Ridge National Laboratory. AECD-2919. [nd.] Decl. Aug. 29, 1950. 8p.

The hydrolytic properties of thorium have been compared with those of the other members of the actinide series to determine how strongly the "rare-earth" hypothesis is supported by the behavior of the ions in aqueous solutions. Highly purified $ThCl_4$ was dissolved in perchlorate and chloride solutions of known acidity and a constant ionic strength of 1.00, the thorium concentration being in the range 0.5×10^{-3} to 1.5×10^{-2}M, and the resulting acidity changes were measured with a vibrating-reed electrometer. It was found that Th(IV) hydrolyzes in a manner qualitatively different from U(IV) and Pu(IV). U(IV) and Pu(IV) yield MOH^{+3} as the initial hydrolysis product and then undergo

slow progressive polymerization, whereas Th(IV) yields ThO^{++} directly, gives no evidence for $ThOH^{+3}$, and has a great tendency to dimerize. On the assumption that all three elements are members of a rare-earth-like series, only small quantitative differences would be expected.

6707 Some Reactions of Elemental Bromine, Hydrogen Bromide and Szilard-Chalmers Bromine with Ethylene Bromide. Gerrit Levey and John E. Willard. University of Wisconsin. AECU-941. [nd.] 14p.

Elemental bromine reacts in the dark with liquid ethylene bromide to form 1,1,2-$C_2H_3Br_3$, with an apparent activation energy of 31.7 kcal/mole in the temperature range from 115 to 140°. Photochemical reaction between radiobromine and ethylene bromide to form organically bound bromine occurs at room temperature. Radiobromine present as hydrogen bromide in liquid ethylene bromide enters organic combination, predominatly as ethylene bromide, with a half-time of the order of hours of the temperature range from 115 to 180°C. Gaseous mixtures of radioactive hydrogen bromide and ethylene bromide, at temperatures between 275 and 338°C, appear to distribute the radiobromine between the organic and inorganic components by a mechanism involving the equilibrium between vinyl bromide and ethylene bromide. Inorganic bromine produced by radiative neutron capture of ethylene bromide reenters organic combination with a measurable rate at temperatures above 119°. Inorganic bromine produced from liquid ethylene bromide by the isomeric transition does not reenter organic combination at a rate which can be observed at temperatures up to 220° (auth)

6708 The Role of Halide Ions in the Ferric-Stannous Reaction. Frederick R. Duke and Richard C. Pinkerton. Iowa State College. AECU-951. [nd.] 14p.

It is confirmed that the reaction of Fe^{+3} ion with Sn^{++} ion in the presence of Cl^- ion is first order in ferric concentration. The reaction exhibits a third-order dependence on Cl^- ion and Br^- ion concentrations. It is second order in I^- ion in the range studied. A third-order dependence may be important at higher concentrations of iodide. The reaction rate is depressed when large amounts of metal ion are present due to complexing and removal of halide. This is markedly so in the case of high Sn^{++} ion concentrations. Approximate values for the equilibrium constants for the formation of $SnCl^+$ and $SnBr^+$ have been obtained. The critical reactant has been found to be $FeCl_3$. By analogy, $FeBr_3$ is probably the critical reactant in the case of the bromide-accelerated reaction. In the order of increasing effectiveness in promoting reaction, Cl^- is less than Br^- and Br^- is less than I^-. It is proposed that it is necessary for the halide ion to be complexed to the oxidizing agent, Fe^{+3} ion, so that it may go through some intermediate state of oxidation. (auth)

6709 Experiments on Compound Formation in Solutions at Low Temperatures. Propene-Iodine and Argon-Boron Trichloride [abstract]. Simon Freed and K. M. Sancier. Brookhaven National Laboratory. AECU-959. [nd.] 2p.

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At 77°K, iodine in liquid propane (supercooled) and in propene is sufficiently soluble to give easily observed spectra. At −45°C (228°K) the solution in propane has the characteristic wine color while the color of the propene solution is amber. At 77°K the absorption peaks are sharpened and shifted. In the ultraviolet region the absorption by the iodine-propane is practically without structure save for two weak bands at about 2500 A. In contrast, iodine-propene exhibits extremely intense absorption matching in character the ultraviolet band studied by Benesi and Hildebrand (J. Am. Chem. Soc. 71, 2703(1949)) in the system iodine-benzene and identified by them as arising in a 1:1 compound. The addition of propene to the solution iodine-propane revealed that the reaction requires heat of activation. The nature of the compound will be discussed.

At 77°K, each mole of liquid propane dissolves about ⅛ mole argon. On bubbling argon through propane containing boron trichloride in solution at 77°K, a precipitate quickly formed which after warming dissolved. The precipitate increased with further addition of argon, but it required successively less warming for its complete dissolution. This behavior suggested that argon enters into compounds with boron trichloride in different proportions somewhat as Booth and Willson (J. Am. Chem. Soc. 57, 2273(1935)) had found when they exposed boron trifluoride near its melting point to argon at high pressures. It seems that the solid containing the higher percentage of argon has the greater solubility.

6710 Acid Catalysis in Concentrated Sulphuric Acid Solutions. Jacob Bigeleisen. Brookhaven National Laboratory. AECU-966. [nd.] 1p.

Some of the literature on the acid catalysis of the decomposition of organic acids in fuming sulfuric acid is very briefly reviewed. The statement is made that this process will be investigated in light of the "acidity function," the presence of two acids, and the complex ionization equilibria between organic acids and sulfuric acid.

6711 A Rapid Sensitive Direct Method for the Routine Determination of Radium in Urine and Other Biological Materials. Edwin R. Russell, Roman C. Lesko, and Jack Schubert. Argonne National Laboratory. AECD-2892. Feb. 28, 1950. Decl. June 9, 1950. 13p.

The best method for routine and repeated determinations of radium in large numbers of individuals is the direct counting of the radium α particles, provided the radium can be separated from large amounts of material. The method given in this paper adequately meets the sensitivity and accuracy required for routine analysis of Ra^{226} in excreta. In outline, the method consists of wet-ashing urine or tissues with concentrated nitric acid, dissolving the ash in 0.1M HNO_3, and coprecipitating the radium with lead sulfate; the lead sulfate precipitate is dissolved in HCl, and the radium is coprecipitated with a few milligrams of $BaCl_2$. The radium-containing $BaCl_2$ precipitate is deposited on a platinum or glass disk, treated with H_2SO_4 to give a uniform adhering deposit, and the sample is counted in a proportional or parallel-plate pulse chamber. An alternative step which may be employed for removing interfering anions involves the use of a cation exchanger to adsorb the radium from the ashed solution, and subsequent elution of the radium with HNO_3. The addition of the ion-exchange step will find use in solutions that have excessive

amounts of interfering anions or cations. Flowsheets and a discussion of the sensitivity of these methods are given.

6712 The Spectrophotometric Determination of Iron in Uranium and Its Compounds. V. A. Fassel, S. M. Tuthill, and O. J. Buckheim. Iowa State College and Mallinckrodt Chemical Works. AECD-2937. July 1947. Decl. Aug. 18, 1950. 19p.

A spectrophotometric determination of iron employing the ferrous-1,10-phenanthroline complex has been developed. The colored complex is measured at a wavelength where interference of the yellow uranyl ion is at a minimum. Recommended procedures and analytical results using these procedures are given. Data are presented which indicate that the iron in the acid-insoluble residue is negligible. A method for the determination of iron in ammonium oxalate is included. (auth)

6713 The Admittance Concept in the Kinetics of Chromatography. J. B. Rosen and Warren E. Winsche. Columbia University and Brookhaven National Laboratory. AECU-965. [nd.] 25p.

Chromatographic processes with linear kinetics can be represented by a system admittance for the case where the influent concentration varies sinusoidally. The admittance has been obtained for a variety of assumed rate-controlling mechanisms and is shown to depend strongly on the type of kinetics obeyed by the system. The results indicate experimental techniques for determining the kinetics of these processes. Representative results obtained with an electronic analogue computer are presented for a case of nonlinear kinetics. (auth)

6714 The Melting Point and the Density of Neptunium Metal; a Micro Melting Point Apparatus for Metals. Edgar F. Westrum, Jr., and LeRoy Eyring. University of California Radiation Laboratory. AECD-2922. Aug. 15, 1950. Decl. Sept. 1, 1950. 9p.

The construction and operation of the microapparatus for the determination of the melting point is illustrated. The apparatus is contained in a pyrex glass bulb connected to a high-vacuum line. The sample and furnace mounted on 2-mm diameter tungsten rods spaced with nonex glass are removable through a standard taper joint. The vital member of the apparatus is the 35-mil diameter tungsten wire "hairpin" between whose carefully plane-ground and polished jaws the globule of metal is placed. The "hairpin" is mounted on a tantalum clamp and surrounded by a cylindrical 2-mil thick tantalum radiation shield 2.2 cm in diameter. A double-glass-insulated iron-constantan thermocouple is spot welded near the sample and serves to measure the sample temperature. Observation of the specimen is made along the axis with a low-power binocular microscope through the polished pyrex optical port. Two independently prepared samples (about 200 μg each) of neptunium metal yielded melting-point values of 639 to 641 and 639.5°C. Densities measured were 16.9 to 20.1 g/cc.

6715 The Heat of Solution of Neptunium Metal and the Heats of Formation of the Neptunium Chlorides; A Microcalorimeter for Heat of Solution Measurements. Edgar F. Westrum, Jr., and LeRoy Eyring.

University of California Radiation Laboratory. AECD-2925. Aug. 1950. Decl. Sept. 1, 1950. 14p.

The thermostat, chassis, and circuits of a calorimeter already described (NNES, Div. IV, Vol. 14B, paper 6.51) were modified. Those changes and special problems connected with the conversion are described.

6716 The Distribution of Uranyl Nitrate from Aqueous Solutions to Diethyl Ether. N. H. Furman, R. J. Mundy, and G. H. Morrison. Princeton University. AECD-2938. [nd.] 72p.

The results of the extensive studies by the Princeton University Analytical Group on the extraction of uranyl nitrate which were initiated early in the Project and reported in numerous papers are presented in collected form. The original intention was to study the distribution to solvents other than diethyl ether, and preliminary experiments were made along these lines. The urgent necessity for data soon made it advisable to confine the work to diethyl ether as the extracting agent. It is believed that the effectiveness of salting agents other than ammonium nitrate was first presented in this series of investigations. Useful procedures have been developed for the efficient recovery of large or small amounts of uranium. The extent to which other substances may extract along with uranyl nitrate has been studied to as great an extent as the circumstances permitted. The distribution coefficients of some 40 elements have been estimated. Special study was given to the distribution of copper, the rare earths, zirconium, titanium, thorium, niobium, boric acid, and radium. The complicating factor of the presence of anions other than nitrate has been studied; the effect of phosphate ion is the most serious as far as retardation of the extraction of uranyl nitrate is concerned. At least a partial solution of the difficulty has been found in the use of ferric nitrate as a salting agent, along with calcium nitrate in continuous extractions. 32 tables. 78 references.

6717 Reaction of Hydrogen Bromide and Bromine with Copper and with Sodium Hydroxide. Gerrit Levey and John E. Willard. University of Wisconsin. AECU-940. [nd.] 2p.

The report is reproduced here in its entirety.

We have investigated the possibility of separating low concentrations of hydrogen bromide from bromine in mixtures with ethylene bromide by passing the pure dry gases through freshly reduced copper or sodium hydroxide.

The free energies (Lewis and Randall, Thermodynamics, N. Y., McGraw-Hill, 1923; Latimer, Oxidation Potentials, N. Y., Prentice Hall, Inc., 1938) of the reactions of copper with dry hydrogen bromide are: $Cu + HBr - CuBr + H$, $\Delta F^\circ = 37$ kcal/mole; and $Cu + HBr - CuBr + \frac{1}{2}H_2$, $\Delta F^\circ = -11$ kcal/mole. It is impossible to predict from these data whether freshly reduced copper will readily remove hydrogen bromide from a gas stream. The kinetics of the second reaction might be very unfavorable to reaction while on the other hand active spots on a freshly reduced copper surface might offer a much more favorable free energy change for the first reaction than that determined from massive copper.

Hydrogen bromide tagged with radioactive Br^{82} was generated in a degassed vacuum system by addition of phosphoric acid to potassium bromide and mixed with degassed ethylene bromide and passed through (a) phosphorus

pentoxide supported on pyrex glass wool which had been cleaned in boiling, fuming nitric acid and (b) 15 cm of 15-mm ID tubing packed with copper wire which had been oxidized in air and freshly reduced with hot hydrogen. The exit gases were frozen out with liquid air in a trap on the evacuated system. In one experiment with 1×10^{-5} mole of hydrogen bromide 82% of the radiobromine became combined with the copper, 8% stayed in the glass-wool train, and 10% passed through to the trap. In a second experiment with 3×10^{-5} mole of hydrogen bromide 66% appeared on the copper, 6% on the glass-wool train, and 28% in the trap. Darkening of the copper was observed when large amounts of hydrogen bromide were passed through.

When elemental bromine was substituted for the hydrogen bromide of the foregoing tests it was quantitatively removed from the ethylene bromide gas stream within the first few centimeters of the copper train.

In agreement with experiments in which soda lime was used (Hamill and Young, J. Chem. Phys. 17, 215 (1949)), we have found hydrogen bromide to be rapidly and quantitatively removed from a gas stream by a train of dry sodium hydroxide but such a train also removes bromine, though less efficiently. In one experiment 30% of about 10^{-9} mole of elemental bromine escaped capture by a 15-cm long, 10-mm ID train of sodium hydroxide pellets which would have completely removed hydrogen bromide.

Macro amounts of bromine and hydrogen bromide in the absence of interfering substances can be separated by fractional condensation (Libby, J. Chem. Phys. 8, 348 (1940); Liberatore and Wiig, J. Chem. Phys. 8, 165 (1940); Jacobsen, J. Chem. Phys. 18, 994 (1950)). Carriers cannot be used to aid in the identification of tracer amounts of these materials by this method, however, because of the rapid exchange which occurs between the two species.

6718 Spectrophotometry of Neptunium in Perchloric Acid Solutions. R. K. Sjoblom and J. C. Hindman. Argonne National Laboratory. AECD-2893. Apr. 14, 1950. Decl. June 8, 1950. 53p.

Details of the absorption spectra of the neptunium (III), (IV), (V), and (VI) ions in 1M perchloric acid are given. The principal bands have been tested for adherence to the Beer-Lambert law. Vibrational fine structure has been found in the absorption spectra of Np(V) and Np(VI). As with U(VI) and Pu(VI), this fine structure is interpreted as being due to symmetrical metal-oxygen vibrations in ions of the types NpO_2^+ and NpO_2^{++}. The vibrational frequency of the Np(V) ion is 753 cm^{-1} and that of the Np(VI) ion is 715 cm^{-1} in 1M $HClO_4$. The interpretation of effect of change in perchloric acid concentration on the absorption spectra of the ions of the various oxidation states is discussed. Preliminary data on the disproportionation reaction $2NP(V) \rightleftharpoons Np(IV) + Np(VI)$, which has been found to occur in concentrated perchloric acid solutions, is given. (auth)

6719 The Infra-red Spectra of $N^{15}N^{14}O^{16}$ and $N^{14}N^{15}O^{16}$; Some Thermodynamic Properties of the Isotopic N_2O Molecules. Jacob Bigeleisen and Lewis Friedman. Brookhaven National Laboratory. AECU-955. [nd.] 14p.

The three fundamental frequencies of $N^{15}N^{14}O^{16}$ have been studied in the infrared. One stretching frequency and the bending frequency in $N^{14}N^{15}O^{16}$ have similarly been investigated. The bending frequencies in $N^{15}N^{14}O^{16}$ are found to be in good agreement with calculations from the product rule. Some slight changes are made in the force constants for the stretching vibrations in N_2O. The stretching frequency ω_3 in $N^{14}N^{15}O^{16}$ provides a good independent check on the force constants. The partition function ratios for isotopic exchange reactions involving nitrogen and oxygen in N_2O are calculated. The isomerization equilibrium $N^{15}N^{14}O^{16} \rightleftharpoons N^{14}N^{15}O^{16}$ has been calculated over the temperature range 273.16 to 1000° K. A correlation is drawn between the structures of the isotopic isomers $N^{15}N^{14}O^{16}$ and $N^{14}N^{15}O^{16}$ and the isomerization equilibrium. (auth)

6720 Reactions of Trace Amounts of Cesium with Ion Exchange Resins. H. S. Miller and G. E. Kline. Kellex Corp. AECD-2932. [nd.] Decl. Aug. 2, 1950. 7p.

The reactions of cesium salts with resins in essentially infinitely dilute solutions, the concentrations involved being as low as 10^{-8} ppm of cesium in solution, have been investigated. Tracer techniques using Cs^{137} were employed. Sulfonic-type ion-exchange resins are effective for the adsorption of cesium from very dilute solutions. Phenol-sulfonic-type resins are also effective and exhibit two pH ranges of strong adsorption, corresponding to the two species of exchange groups present. Cesium is selectively adsorbed by the phenolic groups of Amberlite resin IR-100 in the presence of high concentrations of sodium ions in strongly alkaline solutions. The performance of Amberlite resins IR-100 and IR-120 in the adsorption of cesium is summarized.

6721 Some Observations on the Chemistry of Neptunium. George Gibson, Dieter M. Gruen, and Joseph J. Katz. Argonne National Laboratory. AECD-2895. May 11, 1950. Decl. June 8, 1950. 8p.

This report is reproduced here in its entirety.

Neptunium is known to exist in solution in the +3, +4, +5, and +6 oxidation states, and well defined solid compounds of all but the +5 oxidation state have been reported. Although the ion NpO_2^+ is quite stable with respect to disproportionation in moderately acid solution, Np(V) hydroxide seems to be the only +5 compound to have been isolated from aqueous media. Thus, 8-hydroxyquinoline was found to precipitate neptunium in the +4 and +6 states, but not in the +5 state. Treatment of Np(V) hydroxide with a solution of oxalic acid in t-butyl alcohol produces a green, water-soluble solid whose aqueous solution shows only the Np(V) absorption spectrum. The constitution of this solid phase will be discussed. The only other compound having Np in the +5 state is Np_3O_8 ($NpO_{2.66}$). An acid solution of this material has a spectrum which is a mixture of Np(V) and Np(VI). The spectrophotometric analysis leads to the formula $NpO_{2.58 \pm 0.002}$ compared with $NpO_{2.64 \pm 0.002}$ obtained by decomposition to NpO_2. In an attempt to prepare a higher neptunium chloride, Np_3O_8 was treated with hexachloropropene and CCl_4 under a variety of experimental conditions. Under similar circumstances, U_3O_8 is known to be converted to UCl_4 and partially to UCl_5 and UCl_6. Chlorination of Np_3O_8 was observed only with CCl_4 in the vapor phase. The experimental evidence leading to the conclusion that no higher neptunium chloride exists under the conditions of these experiments is discussed.

CHEMISTRY

6722 Some Properties of Neptunium in the +5 Oxidation State. G. Gibson, D. M. Gruen, and J. J. Katz. Argonne National Laboratory. AECD-2930. Aug. 8, 1950. Decl. Aug. 29, 1950. 22p.

Neptunium has been shown to exist in the +5 and +6 oxidation states in the oxide Np_3O_8. The formula of the oxide calculated from spectrophotometric data is $NpO_{2.55}$. Treatment of Np_3O_8 with (a) liquid-phase hexachloropropene, (b) hexachloropropene under pressure, or (c) carbon tetrachloride under pressure leaves the oxide unaffected. Vapor-phase chlorination of Np_3O_8 at 500°C results only in the formation of $NpCl_4$ and not $NpCl_5$. Reaction of Np(V) hydroxide with a solution of 10% oxalic acid and 10% water in t-butyl alcohol results in the formation of Np(V) oxalate. Ignition data and oxalate analyses are in reasonable agreement with the formula $NpO_2-\underset{\underset{O}{\|}}{OC}-\underset{\underset{O}{\|}}{COO_2}NP.5H_2O$. However, a definitive formula cannot be written until carbon-hydrogen analyses are made. Evidence obtained from water solutions of Np(V) oxalate indicates complexing of NpO_2^+ by oxalate ion. A study of the solubility of Np(V) in ammonium oxalate solutions confirms this and a $K \cong 0.7$ was found for the equilibrium between $[NpO_2C_2O_4]^-$ and $C_2O_4^{--}$. The Np(V) absorption which normally occurs at 983 mμ is shifted to 987 mμ in neutral oxalate solutions. Addition of perchloric acid has been shown to restore the absorption maximum to 983 mμ. (auth)

6723 A New Oxidation State of Americium, Am(VI). L. B. Asprey, S. E. Stephanou, and R. A. Penneman. Los Alamos Scientific Laboratory. AECU-927. [nd.] 10p.

Americium in the formal oxidation state of +6 has been prepared by the oxidation of Am(III) and Am(V) in acid solution. Various methods of obtaining this new state are described, including the disproportionation of Am(V). Sodium americyl acetate, $NaAmO_2(OOCCH_3)_3$, was prepared and has been identified by optical crystallography and x-ray analysis. Treatment of this compound with ferrous ion required 2.9 equivalents per mole of Am(VI) reduced to Am(III). From its crystal behavior and chemical similarity to uranyl, neptunyl, and plutonyl ions, americyl ion is assigned the formula, AmO_2^{++}. The general chemistry of Am(VI) in aqueous solution has been found to be similar in many respects to that of the (VI) state of uranium, neptunium, and plutonium. The absorption spectrum of Am(VI) in perchloric acid solution has been measured in the region from 230 to 1050 mμ. A narrow absorption peak at 992 mμ, a minor peak at 666 mμ, and continuous ultraviolet absorption were observed. The potential of the Am(III)-Am(VI) couple is estimated to be −1.9 volts. (auth)

6724 Heats of Solution of the Uranyl Nitrate Hydrates in Water and in Organic Solvents. Leonard I. Katzin, Dorothy M. Simon, and John R. Ferraro. Argonne National Laboratory. AECD-2894. July 15, 1950. Decl. June 8, 1950. 15p.

The heats of solution of uranyl nitrate hexahydrate, trihydrate, and dihydrate in water and in isobutyl alcohol, diethyl ether, tetrahydrofuran, ethylene glycol diethyl ether, ethylene glycol monoethyl ether, acetone, methyl isobutyl ketone, ethyl malonate, ethyl propionate, and ethyl oxalate have been determined. It is pointed out that the heat of solution of the dihydrate in organic solvents seems largely influenced by the functional group of the solvent. Certain relations between the heats of mixing of solutions of the salt and water in the organic solvent and the base strengths of the solvents are pointed out.

CHEMISTRY

6725 The Absorption Spectra of Uranyl Nitrate in Organic Solvents. L. Kaplan, R. A. Hildebrandt, and M. Ader. Argonne National Laboratory. AECD-2920. Oct. 1, 1950. Decl. Dec. 5, 1950. 19p.

The absorption spectra of uranyl nitrate have been measured in the following solvents: water, acetone, dioxane, ethanol, propanol, chloroform, pyridine, nitroethane, ethyl acetate, glacial acetic acid, and tetraethylene glycol dibutyl ether. The spectra of the solutions have in common a broad absorption band, extending from about 380 to 500 mμ with a maximum around 425 mμ, and exhibit more or less fine structure. Differences among the spectra are explained in terms of a series of (hydrated, solvated) nitrate complexes, UO_2^{++}, $UO_2NO_3^+$, $UO_2(NO_3)_2$, and $UO_2(NO_3)_3^-$, the relative concentrations of which depend on the nature of the solvent, its water content, and the concentration of added nitrates. In concentrated aqueous nitric acid the predominant species is the dinitrate complex, $UO_2(NO_3)_2$. The spectrum of uranyl perchlorate in methyl isobutyl ketone is included, showing the effect of adding various concentrations of tetrabutylammonium nitrate. The solution in acetone is stated to be quite similar.

6726 The Constitution of the Uranates of Sodium. C. A. Wamser, J. Belle, E. Bernsohn, and B. Williamson. Kellex Corp. AECD-2933. [nd.] Decl. Aug. 2, 1950. 7p.

Chemical and x-ray diffraction analysis and the interpretation of pH and conductance data indicate that two sodium uranates, $Na_2U_7O_{22}$ and $Na_6U_7O_{24}$ (or mixtures thereof) are obtained when U is precipitated from uranyl nitrate solution by the addition of NaOH.

6727 The Nephelometric Determination of Chloride in Uranium. S. Wexler and L. S. Myers, Jr. Argonne National Laboratory. AECD-2940. May 10, 1950. Decl. Sept. 14, 1950. 8p.

A routine method for the determination of trace (up to several hundred ppm) chloride in uranium metal and oxide is described. The analysis consists in conversion of uranium to the sulfate with H_2SO_4, steam distillation of the resulting HCl into a Na_2CO_3 solution, formation of a AgCl suspension, and determination of the AgCl concentration by a nephelometric measurement. Recovery experiments indicate an accuracy of approximately 20%.

ENGINEERING

6728 Rate of Formation of Vapor in a Uniformly Heated Liquid. M. S. Plesset. North American Aviation, Inc. AECU-707. Oct. 24, 1949. 11p.

An approximate method for the calculation of the rate of growth of vapor bubbles within the volume of a uniformly heated liquid is developed. The method is directly applicable to the situation in which the effective initial size of the nucleus from which the bubble grows is large enough so that surface tension effects may be neglected. An example is presented in which the temperature rise of the liquid is exponential, and it is shown that the approximate procedure presented here is quite accurate.

MINERALOGY, METALLURGY, AND CERAMICS

6729 Fabrication of Ceramic Shapes. Terence Mullen and James M. Taub. Los Alamos Scientific Laboratory. AECD-2936. Dec. 23, 1946. Decl. July 20, 1950. 11p.

Some of the methods employed at Los Alamos for the fabrication of refractory products are reported. Crucibles have been made of BeO, ThO_2, and CeS, chiefly for experimental purposes. Each of these materials must be treated differently as far as sintering is concerned. The three materials lend themselves well to pressing methods. Refractory supports were required for platinum trays to be heated to 1300°C. Zirconium silicate was chosen for the purpose because of its extremely high resistance to thermal shock. Insulators were required having high and low density. A typical shape of BeO is shown. A small refractory furnace was needed for vapor pressure determinations and MgO was selected for the purpose. The furnace was made by pressing a slug to the outside dimensions of the piece and then dry machining the holes as shown. Disks have been made for cyclotron targets. Typical materials of which these disks were made are UO_2, U_3O_8, Li_2O, LiF, and SrO.

6730 A Method for Preparing Large Tungsten-Copper Pieces. Harold Hirsch. Los Alamos Scientific Laboratory. AECD-2935. Sept. 23, 1946. Decl. July 20, 1950. 11p.

Since large pieces of tungsten copper were not readily available through commercial suppliers, the metallurgy department undertook to study methods for this fabrication. Compositions as high as 80% by weight of tungsten of uniform structure and practically 100% density were produced. The tungsten powder used in all the work had a particle size of approximately 20 microns. The copper employed was classified as commercial grade. No difference was observed in the results between using this type of copper and electrolytic copper powder. The die had a smooth cavity and either was a split die or had a tapered exit to allow the green compact to gradually expand during ejection to prevent laminating. The expansion was of the order of 0.2%. It was possible to use a straight die if the tungsten was coated with 1 to 2% paraffin. This increased green strength but lengthened the heating cycle. Doping with paraffin became essential for tungsten compositions of 55% or lower. (auth)

6731 A Note on Thin Nickel Foils. S. Bashkin and G. Goldhaber. University of Wisconsin. AECU-943. [nd.] 4p.

A method for the preparation of nickel foils down to 250 A thick is described. The foils are electrodeposited on copper backing. The 500 A nickel has a stopping power of 8–10 kev for a 1-Mev proton.

6732 Radioassay Techniques for Low-Grade Uranium Ores and Mineral-Dressing Products; Progress Report. James H. Pannell. M.I.T. Department of Metallurgy. AECD-2889. May 12, 1947. Decl. July 27, 1950. 22p.

The equipment used is similar to that found in other laboratories organized under the Manhattan Engineer District, consisting essentially of a G-M counter and Higinbotham scale of 64. The counter is a cylindrical beta-detecting type

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having a cathode area of about 7½ sq. in. and its wall thickness is stated in terms of actual mass as 30 mg/sq cm, enabling it to count some electrons in the 350-kev range. Samples are weighed (volume measures may be inaccurate) into shallow brass cups which are placed directly beneath the sensitive region of the counting tube which lies at the axis of a horizontal lead chamber. The sample is customarily spread evenly over the bottom of the cup and is smoothed with a lucite tamper. Experiments show, however, that this is not necessary in order to obtain reproducible results; no detectable variations due to differences of density are observed when constant weights are used. Errors in radioassays are due to positioning, sampling, and statistical fluctuations. The procedure, regardless of the actual type of sample holder or counting device, is based upon the comparison of net counts for unknown samples against those for "standard" samples under identical conditions. The reasonable assumption that activity is proportional to amount of uranium present presupposes at least four conditions: (1) equal weights of different samples must have the same absorption properties, (2) the uranium present must be in equilibrium with its daughter elements, (3) all the activity measured must be derived from the uranium disintegration series, and (4) no appreciable percentage of the ionizations produced can be lost by coincidences. The net counting rate due to the sample alone is employed; i.e., the background is always subtracted from the total counting rate.

PHYSICS

6733 Mathematical Data for Electron Drain. S. E. Rauch. University of California Radiation Laboratory. AECD-2809. Nov. 1, 1944. 14p.

Equations of motion of a charged particle when acted upon simultaneously by an electric and a magnetic field are presented. Particular emphasis is given to the electron. The derivation of the equations is not included. The report contains the following four sections: Uniform crossed electric and magnetic fields, E and H; Radial E in a coaxial system, H transverse to coaxial axis; Constant E, circularly bowed H; and Wedge potential region, H transverse to wedge axis. In this work it is assumed that the initial temperatures for electrons or ions is negligible in comparison to the magnitude of energies involved.

6734 Shock Hydrodynamics and Blast Waves. H. A. Bethe, K. Fuchs, J. von Neuman, R. Peierls, and W. G. Penney; notes written by J. O. Hirschfelder. Los Alamos Scientific Laboratory. AECD-2860. Oct. 28, 1944. Decl. Apr. 22, 1949. 106p.

The hydrodynamics of compressible fluids is considered for applications in which motions are so rapid that there is not sufficient time to transfer an appreciable amount of momentum or energy across streamlines and, therefore, viscosity and heat conductivity may be neglected. An application of Riemann's method of integration to one-dimensional, isentropic problems is followed by a treatment of shock waves and discontinuities in one dimension. The difficulties of two- and three-dimensional flow are then considered, and the methods of two-dimensional hydrodynamics are applied to such problems as nozzle and corner flows, oblique shocks, headwaves of wedges, Pitot tubes, flow around

convex corners (rarefaction), and reflection of shock waves from a rigid wall. The method of characteristics (boundaries with streamlines of Mach angles) is developed for two-dimensional stationary problems. Spherical blast waves in air considered as a perfect gas with $\gamma = 1.4$ are extensively studied. Degradation of strong blast waves (not neglecting energy dissipation) and the shape of the blast wave at large distances are derived, and Taylor's treatment (similarity solution), von Neumann's theory (greater generality but still with similarity), and Bethe's modification of the Wentzel-Kramers-Brillouin method (weak shocks, no similarity) are discussed.

6735 Energetic Stars at Different Latitudes. C. B. Fisk, J. Hornbostel, E. O. Salant, and J. E. Smith. Brookhaven National Laboratory. AECU-824. [nd.] 2p.

This report is reproduced here in its entirety.

Eastman NTB3 emulsions were flown to an atmospheric pressure of 15 g/cm² at 57 and 31°N geomagnetic latitudes, cut-offs 2.8 and 8 bev, respectively. About 1000 stars were examined in plates verified as sensitive to minimum ionization tracks. Latitude effect for star production by incident, singly charged, relativistic particles is about the same as reported for particle flux by Winckler et al. (private communication), implying approximately constant cross section, over relevant energy ranges, for proton disintegrations. No significant differences between the two latitudes are found for distribution in either numbers of heavy prongs or multiplicities of outgoing minimum tracks. Considering only stars of 3 or more heavy prongs, data at each latitude show: (a) about ¼ of the stars are caused by relativistic protons, (b) ⅔ of the proton-induced stars have outgoing minimum tracks, presumably mostly relativistic mesons, with an average multiplicity of 3, (c) ⅔ of these stars have 6 or more and ½ have 9 or more heavy prongs, and (d) ½ of all stars contain only heavy prongs, of which only ¼ have 6 or more prongs. This distribution, contrasted with (c), suggests only moderately energetic neutrons as a cause. Angular spreads of minimum tracks will be discussed.

6736 Altitude and Latitude Dependence of Bursts in a Lead-Shielded Ionization Chamber. Allen J. McMahon, Bruno Rossi, and W. F. Burditt. Brookhaven National Laboratory. AECU-961. [nd.] 32p.

An abstract of this report was indexed as report AECU-823 and appeared in its entirety in NSA as abstract 4-3753.

6737 Latitude and Altitude Dependence of the Local Hard Showers of Cosmic Rays. T. G. Walsh and O. Piccioni. Brookhaven National Laboratory. AECU-962. July 11, 1950. 19p.

The latitude effect of local hard showers penetrating at least 350 g/cm² of lead has been measured at two airplane altitudes, and found to be 12 ± 2% between Rome, N.Y., and the Canal Zone. The two separate latitude effects obtained, respectively, at 30,500 ft (300 g/cm²) and at 25,000 ft (383 g/cm²), coincide within the experimental errors. This slow dependence on altitude of the latitude effect seems to allow an estimate of the energy of the hard shower-producing particles as they arrive on the apparatus. An average energy of 20 to 30 bev is obtained from the present data and the current ideas on the absorption of the nucleonic component. Such a large value is discussed in connection with other experiments and in view of the fact that at sea level or at mountain altitudes π mesons of that energy have a large probability of undergoing a nuclear collision before decaying into μ mesons. The measured altitude dependence of hard showers gives for the absorption mean free path of the producing radiation in air, the value of 112 ± 2 g/cm², if interpreted in terms of a simple exponential. However, because of the geometry of the apparatus, the value 140 g/cm², as obtained from the data according to the Gross transform, seems more acceptable when referred to strictly vertical particles. The latitude effect of the normal penetrating component was 1.33 at 30,500 ft, 1.24 at 25,000 ft and 1.08 at sea level. (auth)

6738 A Current Integrator. G. M. B. Bouricius and F. C. Shoemaker. University of Wisconsin. AECU-946. [nd.] 5p.

A current integrator has been developed which is dependable to ±0.1% or better for ion-beam currents of a few hundredths of a microampere or greater. The principle of operation of each of these integrators is the measurement of voltage across a condenser while the condenser is charged or discharged by an ion-beam current. A circuit has been designed which uses a direct-coupled amplifier for the voltage measuring element.

6739 Mass-Spectrographic Identification of Cm^{243} and Cm^{244}. F. L. Reynolds, E. K. Hulet, and K. Street, Jr. University of California Radiation Laboratory. AECD-2899. June 20, 1950. Decl. Aug. 18, 1950. 4p.

The isotopes Cm^{243} and Cm^{244} have been identified mass-spectrographically. The curium fraction from a long neutron irradiation of Am^{241} was separated chemically, and its isotopic composition determined by means of the 60° focusing mass spectrograph. A thermal ion source was used, and the ions were recorded photographically. A photometer tracing of the plate gave the semiquantitative information that Cm^{243} and Cm^{244} were of about equal abundance in the sample and that each was about 1% as abundant as Cm^{242}. From the energy balances involved, Cm^{243} is expected to be slightly unstable with respect to orbital electron capture, or possibly β stable. The α-decay systematics predict that Cm^{244} is stable with an α-decay half life of years.

6740 Angular Distribution of 14-Mev Neutrons Scattered by Tritons. J. H. Coon, C. K. Bockelman, and H. H. Barschall. Los Alamos Scientific Laboratory. AECD-2908. [nd.] 12p.

Tritons recoiling from 14-Mev neutrons were observed in a coincidence-counter telescope. The angular distribution of neutrons scattered through angles between 180 and 90 deg in the center-of-mass system was investigated. Absolute differential scattering cross sections were obtained by comparison with hydrogen. No evidence for the presence of disintegration protons or deuterons was found. (auth)

6741 Velocity Dependent Interactions and Nuclear Shells. C. H. Blanchard and R. Avery. University of Wisconsin. AECU-942. Aug. 1950. 9p.

A theoretical investigation is made of the energy splitting of the two possible j values, $l \pm \frac{1}{2}$, of a single nucleon outside a closed shell resulting from the assumption of certain velocity-dependent terms in the nucleon-nucleon interaction. (auth)

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6742 Total Cross Sections of Be, B, O, and F for Fast Neutrons. C. K. Bockelman. University of Wisconsin. AECU-944. [nd.] 15p.

Previous studies of the cross sections of Be and O as a function of neutron energy have been extended to higher energies. Three resonances in oxygen were observed below 1.4 Mev in agreement with those reported by Freier et al. (see NSA 4-4372). In the range from 0.2 to 1.4 Mev, two resonances were found for Be. For energies below 1 Mev, one level was observed in B, while evidence for at least seven resonances was found for F in the energy interval from 0.01 to 0.7 Mev. The assignment of reduced widths and spin values to the compound states is possible in certain cases.

6743 The Bare Intermediate Reactor; The Approach to Critical. Nicholas M. Smith. Oak Ridge National Laboratory. AECD-2945. Apr. 18, 1950. Decl. July 26, 1950. 13p.

The extension of bare reactor theory to the intermediate case has been formulated. Development of the theory has been based on the following assumptions: that the reactor is of sufficient size so that the more simple diffusion and slowing-down theories may be applied, that all of the dimensions are somewhat greater than the transport mean-free-path, and that the extrapolation length is energy dependent. The theory is then considered with reference to previous characteristic functions and fundamental reactor theory.

6744 Cross Section for the Reaction $T(d,n)He^4$. T. W. Bonner. Los Alamos Scientific Laboratory. AECU-939. Aug. 1950. 9p.

Experimental curves were obtained of the cross section of the reaction $T(d,n)He^4$ as a function of deuteron energies between 10.6 and 133 kev. Peaks of 6.9 and 7.2 barns were found at 110 kev. The data were obtained by bombarding thin targets of zirconium-tritium, the technique of which had been developed at Rice Institute, with deuterons and by detecting the resultant α particles with a proportional counter.

6745 Interaction of Fast Neutrons with Nitrogen. C. H. Johnson and H. H. Barschall. University of Wisconsin. AECU-945. [nd.] 24p.

Using neutrons from the $Li^7(p,n)Be^7$ reaction, the cross sections for the reactions $N^{14}(n,p)C^{14}$ and $N^{14}(n,\alpha)B^{11}$ were measured for neutron energies from 150 to 2100 kev. Resonances for the (n,p) reaction were found at 499, 640, 993, and 1415 kev; for the (n,α) reaction, at 1415 and 1800 kev. Information was obtained about the excited state of Be^7. It was found to lie 431 ± 5 kev above the ground state, and probabilities for its formation in the Li(p,n) reaction were determined. (auth)

6746 Note on Angular Asymmetries in (γ,n) Reactions [Abstract]. H. L. Poss. Brookhaven National Laboratory. AECU-957. June 7, 1950. 4p.

This report is reproduced here in its entirety.

The (n,p) threshold reaction in Al has been used to detect photoneutrons emitted from Bi, Pb, and W targets irradiated with x rays produced by a 20-Mev betatron. Emission of photoneutrons was found to be more prevalent at right angles to the x-ray beam than in the direction of the beam. This asymmetry for fast neutrons [(the (n,p) reaction in Al has a threshold of 4.6 Mev for a probability of barrier penetration by the emitted proton of ½(Feld, Scalettar, and Szilard, Phys. Rev. 71, 464(1947)] is in contrast to the symmetrical distributions found for Pb and Fe by Price and Kerst (Phys. Rev. 77, 806(1950)) who used a detector responding to slow neutrons as well. The detector consisted of a stack of Al plates enclosed in 1/32-in. Cd. Their activity was measured with a thin-walled cylindrical Geiger counter following the end of a 10-min irradiation. A decay curve was plotted in each case. With the exception of the first few minutes, during which an activity attributed to 2.3-min Al^{28} was noticeable, the points could be fitted to a 9.6-min half life which has been established for the Mg^{27} end product of the Al(n,p) reaction (Eklund and Hole, Arkiv. Mat. Astron. Fysik 29A, No. 26(1943)). Targets were ¾-in.-diameter cylinders, 3 in. long, the W being in the form of the metal powder while the Pb and Bi were solid cylinders. The x-ray beam was perpendicular to the axis of the cylinder. During an irradiation, the betatron intensity as indicated by a monitor ionization chamber was kept constant to about 10%. Partial corrections for fluctuations in intensity were made by normalizing each initial activity to the same total number of roentgens. The background of fast neutrons generated by the betatron made it necessary to sacrifice resolution by placing the detector adjacent to the target. Measurements were made at 0 deg and at both 90-deg positions with respect to the beam. A C target was used to take into account the background. The threshold of the detector together with the high (γ,n) threshold for C would prevent photoneutrons from being detected in this case. The resultant activities, about the same for each position, are attributed to neutrons in the x-ray beam being scattered by the target or reaching the detector directly. Since the C target scatters neutrons to roughly the same extent as do the other target materials used, these activities are just subtracted from the others to obtain the net photoneutron effect. The results of at least two independent sets of measurements on each element are in the range $N_{90°}/N_{0°} = 2.0 \pm 0.5$. Within the limits of error, no significant differences for the different targets were noticed. An angular dependence of the form $A + B \sin^2\theta$ would be expected if photodisintegrations are principally due to dipole transitions. Because of the continuous nature of both the x-ray spectrum and the energy sensitivity of the detector, as well as the poor resolution, the experimental ratio is difficult to compare directly with theory, but it is in qualitative agreement with considerations based on a shell-structure model of nuclei. If an average cross section of 0.025 barn for the Al(n,p) reaction is assumed (Cohen, Technical Report No. 3, Carnegie Institute of Technology (1949)), then comparing the results of these measurements with those of Price and Kerst on total neutron yields, it appears that of the order of 1/10 of the total photoneutrons from Pb or Bi are fast enough to activate the Al detector.

6747 Neutron-Deuteron Scattering at 4.5 and 5.5 Mev. Ernest Wantuch. Brookhaven National Laboratory. AECU-964. June 12, 1950. 6p.

The angular distribution and differential cross section of 4.5- and 5.5-Mev neutrons scattered by deuterons were investigated with deuterium gas or heavy paraffin serving as scatterer. The ratio of differential cross section at 180 deg to value at minimum is ~5:1. (See also NSA 4-5960.)

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6748 The Half-Life of Indium. Budd Russell and A. Wattenberg. University of Chicago Metallurgical Laboratory. AECD-2926. Oct. 19, 1945. Decl. Dec. 5, 1950. 12p.

A precision determination of the half life of In^{115} has been made, and the value found is 54.31 ± 0.07 min. The measurements were made on a Geiger counter which was calibrated for counting-rate losses. Two exponential-decay tables using $\tau = 78.35$ min are included with this report for the convenience of those working with indium foils.

6749 The L X-ray Spectra from Radioactive Decay of Transuranium Elements. G. W. Barton, Jr., H. P. Robinson, and I. Perlman. University of California Radiation Laboratory. AECD-2944. July 28, 1950. Decl. Sept. 26, 1950. 26p.

A bent-crystal x-ray spectrometer is described and some results are given on the analysis of L-series x rays produced in radioactive decay processes of transuranium elements. There is generally good agreement between measured energy values of L-series lines and those predicted by the Moseley relationship. The relative intensities of the various lines, produced in this case from γ-ray internal conversion, are compared with those emitted from uranium excited by electron bombardment and with values reported of internal-conversion-excited x rays in the region of lead. (auth)

6750 Interaction Effects in Radiative Transitions in Nuclei. N. Austern and R. G. Sachs. University of Wisconsin. AECU-947. [nd.] 29p.

Electromagnetic transition processes in nuclei are considered on the assumption that the influence of an external electromagnetic field on a nucleus can be incorporated into a gauge-invariant Schroedinger equation for the nucleons (phenomenological theory). From the results of an accompanying paper (see following abstract) it is concluded that equations for electric-multipole transition probabilities have the usual form but that the f-sum rule is modified in a manner depending on the nuclear interactions. Explicit expressions for the generalization of the f-sum rule to all electric-multipole orders are given for exchange and velocity-dependent interactions. The magnetic-multipole moments, and therefore the corresponding transition probabilities, depend markedly on the form of the interaction

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with the electromagnetic field. General formulas are given for all magnetic-multipole moments of nuclei in which exchange forces and velocity-dependent interactions play a role. In addition it is possible to incorporate into the theory the spin-antisymmetric addition to the magnetic-dipole moment implied by the static moments of H^3 and He^3. Detailed application is limited in this paper to magnetic-dipole transitions. The theoretical cross section for the capture of thermal neutrons by protons is found to have about a 4% addition, due entirely to the spin-interactions, and the velocity interaction proposed to account for high-energy nucleon-nucleon scattering contributes to the magnetic-dipole transitions. The ratio of magnetic dipole to electric-quadrupole transition probabilities is of the order of $(25/\hbar\omega)^2 A^{-\frac{1}{3}}$, where A is the nuclear mass number and $\hbar\omega$ is the photon energy in Mev. Similar emphasis of the magnetic over electric transitions at low energies is anticipated for higher multipole orders, so interpretations of isomeric transitions on the basis of lifetime require re-examination. (auth)

6751 Consequences of Gauge Invariance for Radiative Transitions. R. G. Sachs and N. Austern. University of Wisconsin. AECU-948. [nd.] 14p.

Consideration is given to any system of particles whose behavior under the influence of an external electromagnetic field can be described by a gauge-invariant Schroedinger equation. Detailed restrictions on the form of the Hamiltonian which are imposed by the conditions of gauge invariance are derived. These provide a simple means to the solution of many problems of the interaction of a system with the electromagnetic field. In particular the following consequences are established: (1) In multipole expansions for single-photon processes the electric-multipole operators have the usual form, but the form of the magnetic-multipole operators may depend in a detailed way on the interactions between particles and electromagnetic field. (2) The f-sum rule can be expressed in closed form in terms of the interactions. (3) A generalization of the f-sum rule to all electric multipole orders is given. (4) The cross section for scattering of a low-energy photon can be expressed in terms of the electrostatic polarizability quite independently of the interactions. Applications of these methods to problems in nuclear physics are given in an accompanying paper (see preceding abstract). (auth)

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